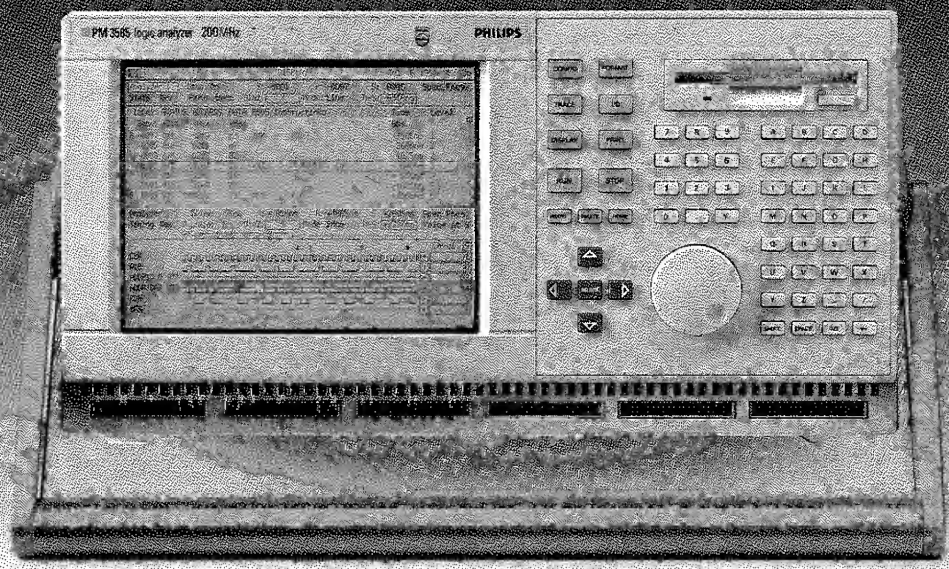
LOGIC ANALYZERS
PM 3580/PM 3585
User manual



FLUKE AND PHILIPS - THE GLOBAL ALLIANCE IN TEST & MEASUREMENT

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LOGIC ANALYZERS
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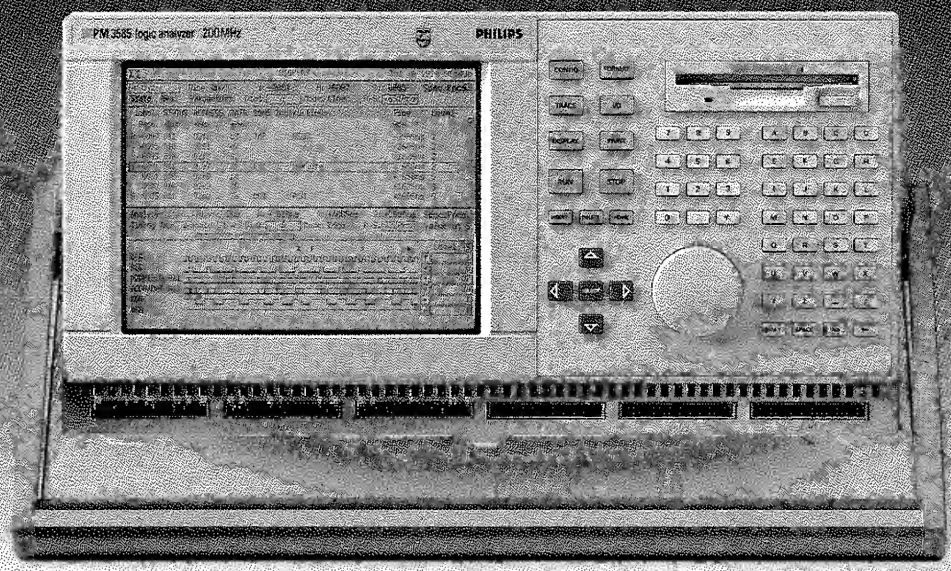

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NOTE
PF 8690/00

Indicator	:	Customer information.
Indicator number	:	CIS 1116
Concerns	:	PF 8690/00 System Software, **Version 1.03**, English for PM 3580/PM 3585 Logic Analyzers
Issue date	:	October 1991
To be inserted in	:	PM 3580/PM 3585 User Manual

General

Please read the following notes carefully before you start working. They contain some important information on the differences between this and previous versions, as well as describing a number of minor limitations and restrictions.

Version 1.03 software contains a number of significant enhancements, as well as a number of cosmetic changes and bug-fixes. Most of the enhancements relate to the display capabilities and Chapter 6 of the User Manual ("Analyzing the Data") has been extended. A brief list of the new display features, as well as the other changes, follows. For full details, refer to the User Manual.

New DISPLAY Menu Features

- Waveform display mode for state data.
- List display for timing data.
- Graph display for bus data ("chart mode").
- Accumulate mode for waveform data.
- Cursor control/readout (X, Y, R, S, R-S) can be in samples or time.
- Coscroll of upper/lower screens can be in samples or time.
- Waveform displays can be reset to a default "Best" horizontal scale (T/Div or S/Div).

Publication Number 4022 104 94371

ous versions this sometimes "disappeared" as the cursor was scrolled past another non-active cursor).

- Disassembler files are protected from being inadvertently deleted/overwritten.
- After executing a "System reset" in the CONFIG menu, disas will be (re-)loaded from disk when required and not from memory as is currently the case in previous software versions.

Cosmetic changes and Bug-Fixes

System version 1.03 contains many small changes, including fixes for some bugs and inconsistencies which have been discovered and a number of small improvements relating to the operation ("cosmetic" changes). The most significant of these are:

- The pre-defined trigger sequence:
  $t_7 <$ Pulse duration $< (t_7+t_8)$
  does not work correctly in previous versions. This has now been changed to:
  $t_7 <$ Pulse duration $< t_8$
  This sequence now works correctly. You fill in the same pattern values for tw_7 and tw_8 and the required lower/upper time limits for t_7 and t_8.
- In previous versions, under certain conditions the trigger point was flagged in the displayed data in the wrong place. This has been corrected.
- Range value in TRACE can now be entered in decimal mode.
- The DELETE action in the FIND window in a state and timing list has been inhibited. This lead a number of users to inadvertently delete labels.
- In Auto-Repeat mode ("stop on state not-equal") previous software versions compared all channels (whether defined for state acquisition or not). This could in certain

The R-S field in the display only gives 3/4 figure accuracy, so resolution is lost when the units are10us or longer. If greater accuracy is required in a time difference measurement the individual R and S cursor values must be read out individually and manually subtracted (see page 76 of the Reference Guide).

Time Point Reconstructions

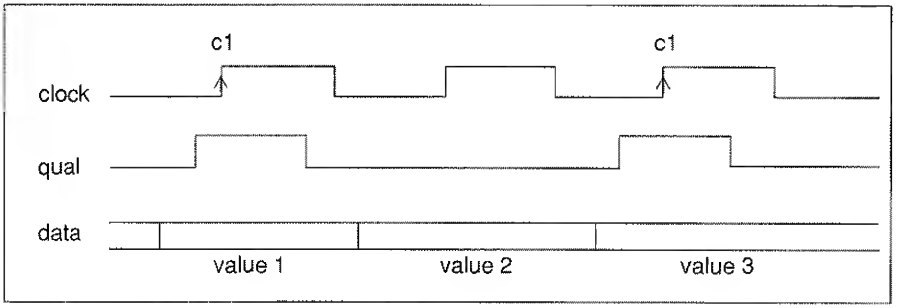
After stopping data acquisition and before displaying the data, a software algorithm is used to locate the precise trigger point in the data. Every effort has been made to minimize the time taken, though in certain cases (usually complex trigger sequences) it can still be rather long (several seconds).

Manual Synchronization of Disassemblers

Synchronization information entered in the display via the Disa Parameters pop-up is not saved in the measurement file.

Immediate state word triggering does not always work correctly when clocks are qualified. This typically applies in the case of processors such as the 80286, and is illustrated by the diagram below. A qualified clock, c1, is defined when the signal "qual" is high. Defining an immediate trigger condition "If sw_{12}" with "sw_1=value1" and "sw_2=value3" will not cause the analyzer to trigger. This is because the immediate word recognizer incorrectly "sees" the unqualified "value 2". To trigger correctly, you should use the 2 level sequence as follows:

L_1	If	sw1	goto L_2
L_2	If	sw2	Stop
	Or if	$\overline{sw2}$	goto L_1



Measurement File Format

Version 1.03 has extensions to the format of the measurement files. Files created by version 1.03 can not be read on systems booted with earlier software versions. However, files created by these versions can still be read on systems booted with version 1.03.

	SUN raster image format for subsequent processing (eg. import into document).
• RASCONV.MAN	On-disk manual (DOS-text) for RASCONV.

LOGIC ANALYZERS
PM 3580 / PM 3585
User manual

PHILIPS

Dual logic analysis

PF8690/00 System Software
Software Version 1.0, English
I&E, Test & Measurement

Publication Number 4022 104 90171

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Printed in the Netherlands

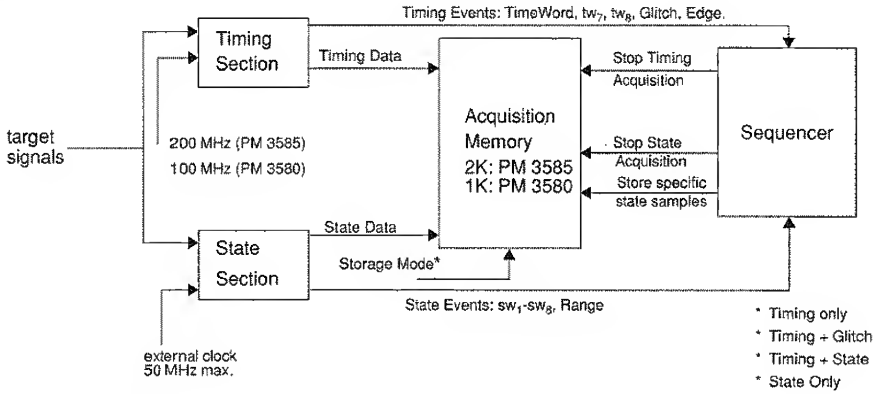
Thank you for purchasing this PHILIPS logic analyzer. It has been designed and manufactured to the highest quality standards to give you many years of trouble-free and accurate measurements.

Should you have any comments on how this product could be improved then please contact your local Fluke/Philips representative. Fluke/Philips addresses are listed in chapter 11 of this User Manual.

Chapter 1

Introduction

The new Dual Analysis Per Pin (DAPP) architecture makes simultaneous state ***and*** timing analysis possible per pin with ***single probing***. The basic DAPP architecture is shown below.



Simultaneous State and Timing Per Pin

Both a timing section and a state section simultaneously observe the same target signals. The pattern recognition results (timing events and state events) of both sections are routed to one common sequencer. The sampled timing and state data are routed to the acquisition memory which can store a total of 2K samples (1K for PM 3580 units) and which you can assign to timing only data (100%), timing + glitch data (50%/50%), timing + state data (50%/50%), or state only data (100%).

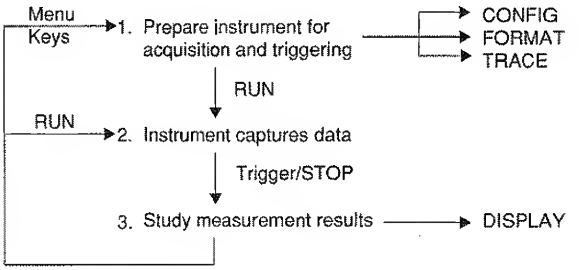
The pattern recognition logic for state and timing patterns operates independently from the storage mode you select. This allows you always to search for state and timing patterns in parallel.

PM3585: Two Analyzers

Inside your PM 3585 Logic Analyzer there are two independant Logic Analyzers, both having this unique Dual Analysis Per Pin architecture. These two analyzers can

Basic Measurement Loop

In using a logic analyzer you generally go through the following basic measurement loop:



In the first step you prepare the instrument for data acquisition. You should specify:

1. Which pods are relevant,
2. The threshold levels of the signals,
3. The signal names and attributes,
4. The sequence of patterns to search for,
5. Which data is to be stored (Timing only, Timing + Glitch, Timing + State, or State only).

You do this by using the 3 menus referred to as:

- Configuration (CONFIG)
- Format (FORMAT)
- Trace (TRACE)

After you have set up the instrument, press the *RUN* key.

The analyzer now captures data and searches for the sequence of patterns specified. As soon as the analyzer has found the trigger sequence, it stops data acquisition and shows you the results in the DISPLAY menu.

You can then study the results, measuring how long signals show a specific level; how long program loops are etc..

The next two pages show you an overview of the four major menus (CONFIG, FORMAT, TRACE and DISPLAY) used during measurements, with typical entries. Compare the "Dual Analysis Per Pin (DAPP) Mode" in the *PM 3580/PM 3585 Getting Started Guide.*

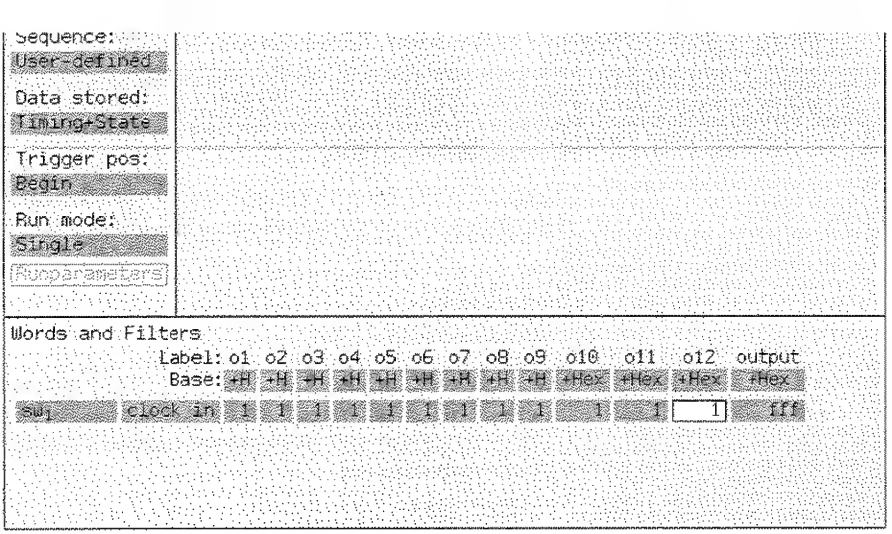
Manuals

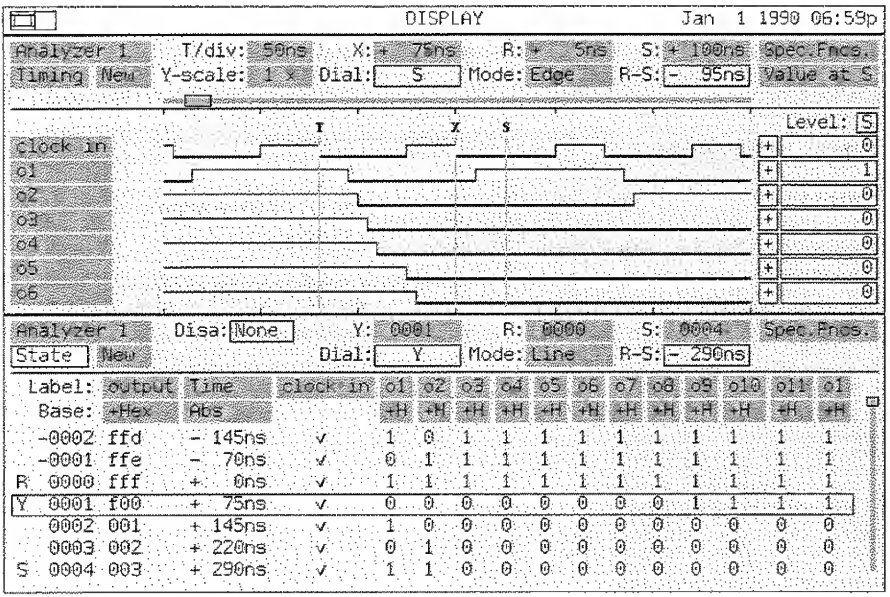
All menus are of the type "fill in the form". Each menu is extensively described in the *PM 3580/PM 3585 Reference Guide.* This guide is organized per menu. Given a menu, it concisely describes per field the purpose of the field and all the possible options.

The *PM 3580/PM 3585 Getting Started Guide* leads you through the different menus by means of a number of examples. In this guide the front and rear panels of the instrument are also described.

This manual, the *PM 3580/PM 3585 User Manual*, gives more background information with respect to the concepts implemented in your instrument. It explains, besides other things, the concepts and possibilities of the State Clock mechanism and sequencer. It also contains a number of more advanced examples. Understanding the background information provided in this manual allows you to get the most out of your instrument.

The *PM 3580/PM 3585 Service Manual* helps you in troubleshooting and repair at module level. It also contains the performance verification procedures for checking out the performance of your instrument.

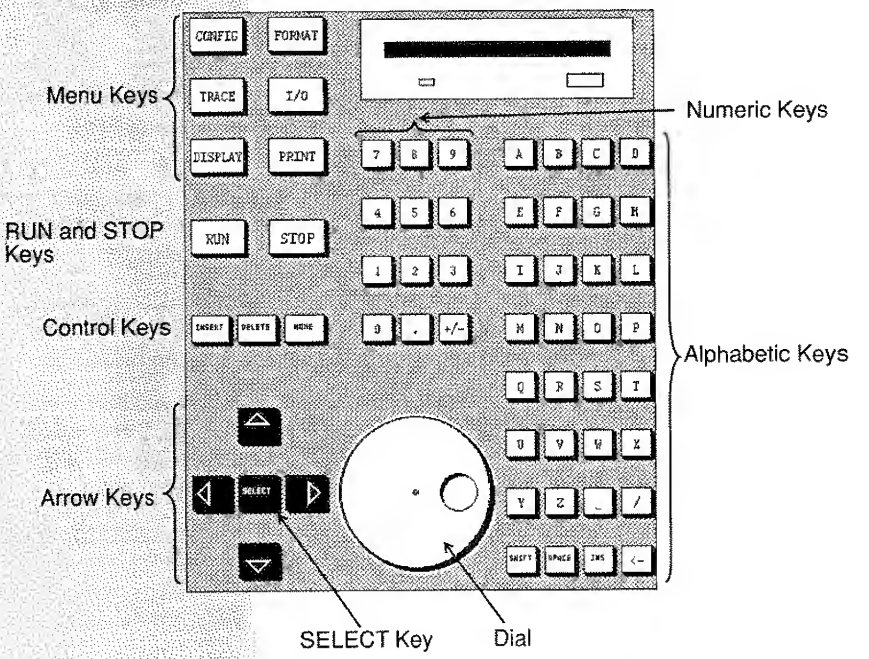

Sequence:
User-defined
Data stored:
Timing+State
Trigger pos:
Begin
Run mode:
Single
Runparameters
Words and Filters
Label: o1 o2 o3 o4 o5 o6 o7 o8 o9 o10 o11 o12 output
Base: +H +H +H +H +H +H +H +H +H +Hex +Hex +Hex +Hex
sw1 clock in 1 1 1 1 1 1 1 1 1 1 1 1 fff

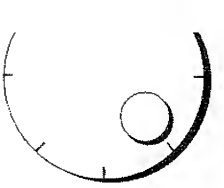

DISPLAY
Jan 1 1990 06:59p
Analyzer 1
Timing New
T/div: 50ns
Y-scale: 1 x
X: + 75ns
Dial: S
R: + 5ns
Mode: Edge
S: + 100ns
R-S: - 95ns
Spec.Fncs.
Value at S
Level: S
clock in
o1
o2
o3
o4
o5
o6
Analyzer 1
State New
Disa: None
Y: 0001
Dial: Y
R: 0000
Mode: Line
S: 0004
R-S: - 290ns
Spec.Fncs.
Label: output Time clock in o1 o2 o3 o4 o5 o6 o7 o8 o9 o10 o11 o12
Base: +Hex Abs +H +H +H +H +H +H +H +H +H +H +H +H
-0002 ffd - 145ns 1 0 1 1 1 1 1 1 1 1 1 1
-0001 ffe - 70ns 0 1 1 1 1 1 1 1 1 1 1 1
R 0000 fff + 0ns 1 1 1 1 1 1 1 1 1 1 1 1
Y 0001 f00 + 75ns 0 0 0 0 0 0 0 0 1 1 1 1
0002 001 + 145ns 1 0 0 0 0 0 0 0 0 0 0 0
0003 002 + 220ns 0 1 0 0 0 0 0 0 0 0 0 0
S 0004 003 + 290ns 1 1 0 0 0 0 0 0 0 0 0 0

Chapter 2

Overview of the Instrument

The PM 3580/ PM 3585 Logic Analyzer keyboard is logically grouped into several areas, plus the dial, as shown below. These areas, and the effect of their keys is as follows:



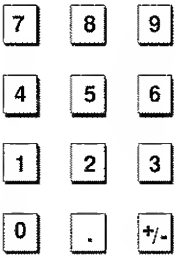


list or popup menu. (These terms are defined in the next chapter.) On the Display menu, however, the dial is used to scroll the data displayed or to move the selected cursor.

Select Key

The *SELECT* key is used to select an action, toggle a value, and to end a numeric entry. (It has a function similar to the Enter or Return key of a computer keyboard.) The specific function of the *SELECT* key is explained in the relevant places.

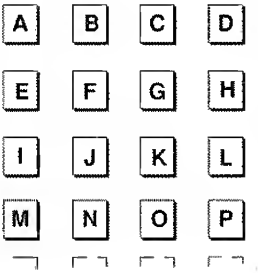
Numeric Keys



The numeric keys allow the entry of numeric data and numbers within names.

The +/- key can be used to toggle the sign in numeric fields.

Alphabetic Keys

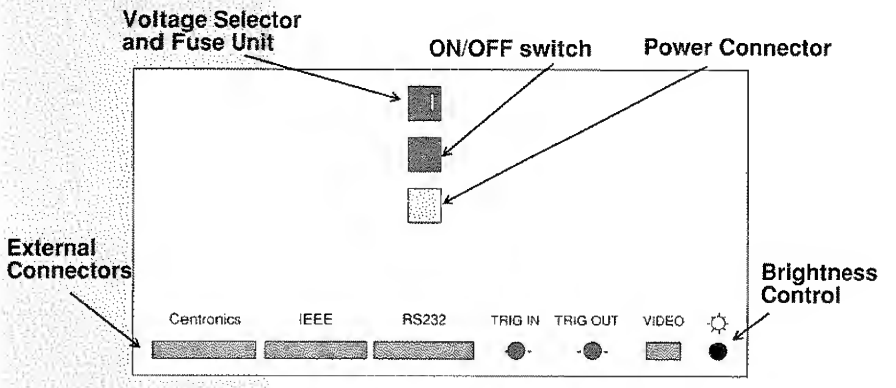


The alphabetic keys are used to rename the analyzer, signals, and files, etc. They can also be used to make quick selections from lists and to define units of measurement.

The alphabetic keys consist of the characters A through Z, the underscore, the forward slash, and the space.

The rear panel has all the external connectors (communication interfaces, printer output, video output, trig in and out), the brightness control, power connection and the ON/OFF switch. The illustration at the foot of the page shows the connectors located at the bottom of the rear panel (described from left to right).

- Centronics connector: A female 25-pin 'D' connector for the attachment of a parallel printer with a Centronics interface.
- IEEE connector: optional IEEE-488 (24 pins) connector for remote operation.
- RS232 connector: A male 25-pin 'D' connector for the attachment of a serial mouse.
- TRIG IN connector: A male BNC connector by which a trigger pulse from another instrument can be input to the logic analyzer.
- TRIG OUT connector: A male BNC connector for supplying an external trigger pulse from the Logic Analyzer to another instrument.



Chapter 3

Menu Overview

Repeat Mode Timer

To the right of the analyzer activity indicators, if the analyzer is in repeat mode (see Chapter 5, "Trace Control"), the repeat mode timer is shown. If auto-repeat is defined but not active, the repeat mode time is *light gray.*

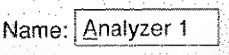
If auto-repeat is defined and active, the repeat mode time is *black and counting down* during the time interval between runs.

Menu Fields

On each menu, there are a number of fields. These are the small white or gray boxes containing text. The currently active field is highlighted: it is the one with a white background. Key press actions only affect highlighted fields. You use the arrow keys or the dial to move the highlight from field to field.

To do something with the instrument, you will select the appropriate menu, highlight the appropriate field, and then press the appropriate key to do the action you want done. (While you are getting to know the instrument, this will most often be the *SELECT* key. You can also think of the *SELECT* key as a kind of help function.)

The Analyzer Name Field



All the major menus concerning analyzers (*i.e.,* except the I/O menu) contain a field in which the current analyzer name is shown. On the Configuration menu, if you have a PM 3585 instrument, there are two such fields, one for each analyzer.

The default names, used throughout the documentation, are Analyzer 1 and (on PM 3585) Analyzer 2. These names can be changed on the Configuration menu. The

check field is not selected, the check (✔) that it is selected.

First Character Select:

Press the initial character of one of the options. (The appropriate options are shown in the *Reference Guide.*) Alternatively press *SELECT* to show the list of options.

List: In these fields, the first character selection is not available. Press *SELECT* to show the list of options.

The "▶" symbol after an option on a list indicates that on pressing *SELECT* or the right arrow on the option, a list or popup menu is shown appropriate to the option. When this "child" menu is closed, the "parent" menu is closed too.

Popup Menu:

Press *SELECT* to show a popup menu. The first field of any popup menu, in the *home* position, is the return field. To indicate that all changes have been made on the popup menu and to close the menu, press the *SELECT* or the *HOME* key on this field. The return field is a function field (see below).

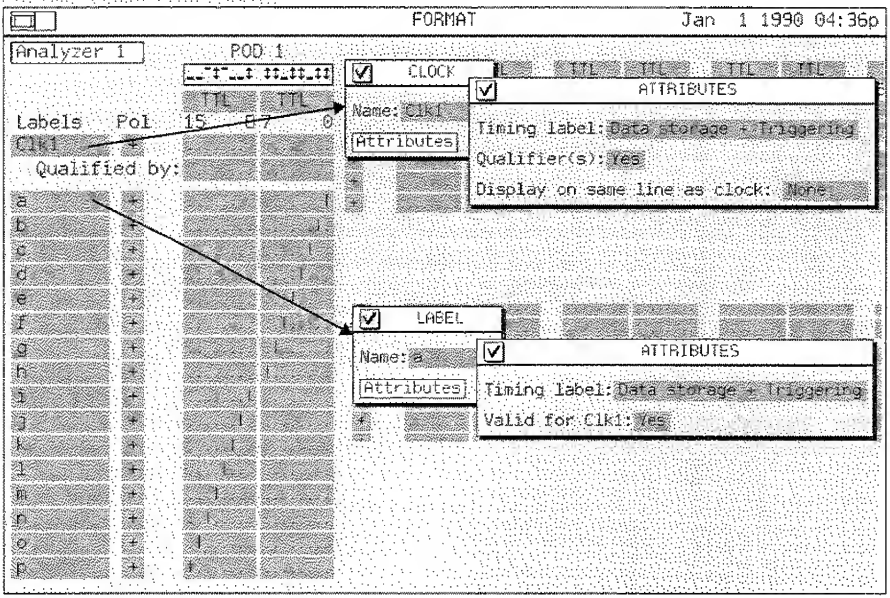
Function: When you press *SELECT* on a highlighted function field, the action described by the field is performed.

signment arrows). This is done by highlighting the pod you want to assign or deassign and then pressing *SELECT* to toggle the arrow between the two analyzers and none.

Pressing *DELETE* also causes the arrow to disappear.

- See the activity on the pods (the pod activity indicators). These fields (information only) show the current activity of the signals of the associated pod. Activity is high (‾), low (_), or changing (‡).
- Reset the instrument to its start-up condition (*System Reset* field). On selection, a confirmation popup menu (Yes/No) is shown. If you select *Yes*, the system is first reset to the factory preset condition. If there is an auto-load file on the disk, this is then loaded.

The figure below shows the two popup menus for clock attributes, and label attributes. These popup menus give you access to more advanced parameters (attributes) of clock and data labels. The attribute *Timing label* is discussed below. The other attributes: *Qualifier(s), Display on same line as clock* and *Valid for Clock* are explained in Chapter 4, "State Clocks". The menu for the current signal is popped up by pressing *SELECT* on its label field. By pressing *SELECT* on the Attribute field in this menu, the attributes menu is popped up.



Timing label Attribute

The *Timing label* attribute allows you to switch off timing analysis for a specific label or clock.

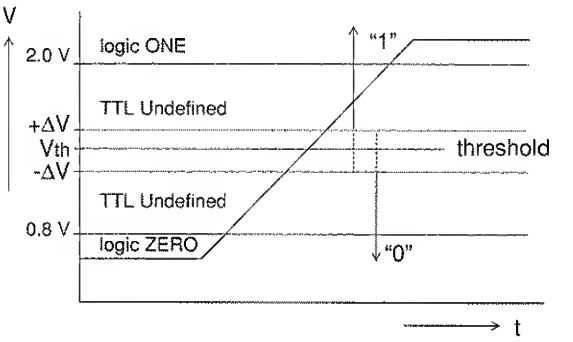
Because of the Dual Analysis Per Pin architecture the PM3580/PM3585 Logic Analyzers capture both state and timing data simultaneously for all channels of all pods

can still specify trigger patterns (on the Trace menu) including conditions for these signals.

The Threshold Level

The analyzer interprets captured data as a logical 1 or 0 depending on whether or not the voltage exceeds the threshold selected in the threshold field.

As all logic analyzers, the PM 3580 and the PM 3585 use a threshold detector on each channel. This is based on a comparator which compares the data input level with a user selectable threshold. Typical thresholds used are TTL (+1.4V) and ECL (-1.3V).



Note that this principle will always result in either a logic ONE or a logic ZERO. Undefined levels are still interpreted as one or the other, depending on their value with respect to the selected threshold.

If you are dealing with a noisy system, using different thresholds will show you how critical the noise on your system is.

Please pay attention to the overdrive required (+ΔV / –ΔV in the above figure) with respect to the threshold voltage. A rising edge must pass through V_{th} + ΔV before it is re-

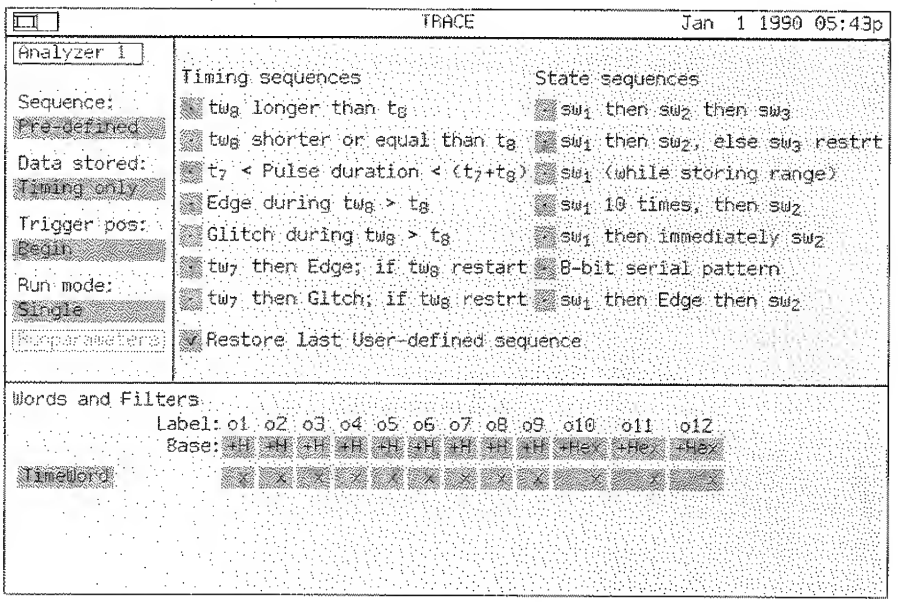
Thus if the polarity is toggled (on the Format menu), you will see a corresponding change and adjustment in the trigger words and on the displays.

On first displaying the menu, the cursor (highlighted box) is on the analyzer field in the Run Definition area.

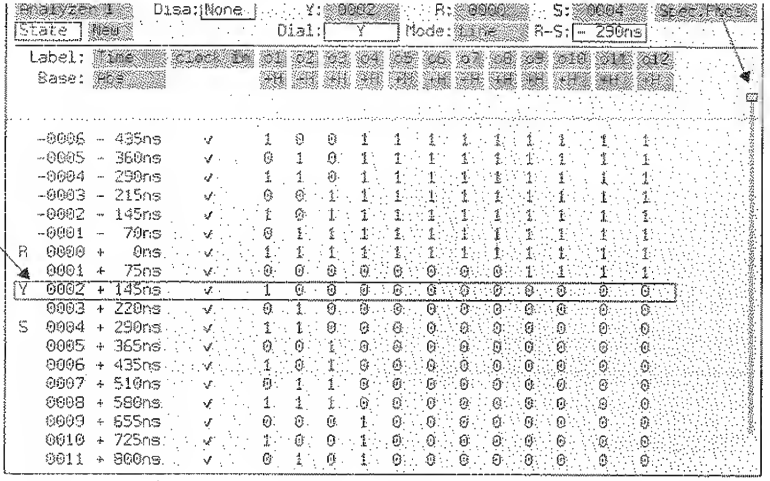
Run Definition Area

In the Run Definition area you can:

- Change between the first and second analyzer on PM 3585 instruments if both analyzers have pods assigned. (The *Analyzer* field.)
- Define the type of sequence to be used in the sequencer area (the *Sequence Type* field). You can choose between predefined sequences (shown at the bottom of the page), user-defined sequences (the default shown on the previous page) and restart sequences. Restart sequences are the same as user-defined, except that the *or if* condition is used as a restart condition. That is, at



The trigger words area is where you define the patterns that the sequencer is to match on. This is fully explained in Chapter 5, "Trace Control".



Display Cursors

For timing and state displays, the center-point of the display (the X cursor for timing, and Y cursor for state) can be scrolled with the dial in a number of different modes. Two freely-definable cursors (called R and S cursors) can also be moved independently of the center cursor, also in a number of modes.

Scrolling Modes

The scrolling modes allow quick paging, medium division, or fine step-wise movement through acquisition memory. It also allows movement from one item to the next, where the items are edges, glitches, sequencer levels, compared signal differences or equalities or, on state displays, a defined pattern.

New and Reference Data

On PM 3580 instruments there are two memories: one for newly-acquired data, and one for reference data. PM 3585 instruments have twice as much: two memories for each analyzer.

Both timing and state displays allow you to see either the newly-acquired data or the reference data, or a comparison display. You copy data to the reference memory using the Display Special functions menu, as described below.

If there is only one trigger point in memory (*newly* acquired timing *and* state data for *both* Analyzer 1 and 2), then that is taken as T_0. If there is more than one such trigger point, then that trigger point with the earliest time is the time origin.

In either of these cases, samples occurring *before* T_0 will then have a negative time value associated with them.

If there is no trigger point in memory (the trigger has been lost) then the oldest sample in memory is taken to be T_0.

For more details, refer to Chapter 6, "Analyzing the Data": "Time Origin - T_0".

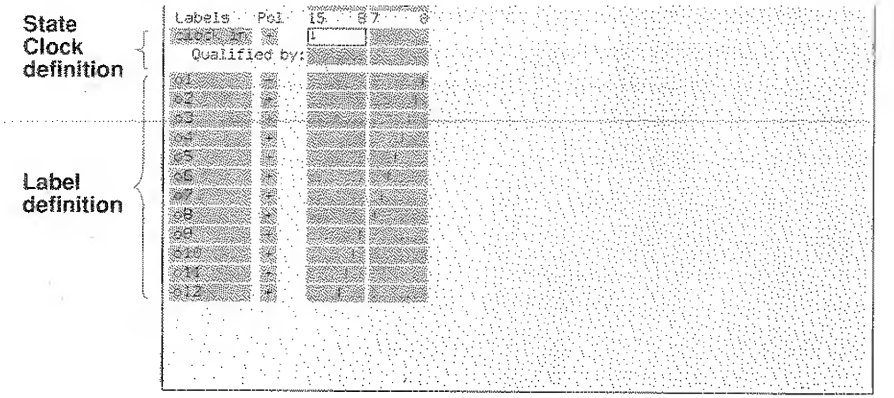
tings are saved together in one file having a name you specify. Settings and data cannot be saved separately.

If a measurement is loaded, all data and instrument settings contained in the file specified, are loaded. Settings and data cannot be loaded separately.

2. To copy complete disks you can use the "copy disk" utility on the utility disk delivered with your instrument. For details refer to Chapter 12, "Utilities".
3. Because the file format is MS-DOS compatible, you can also use your PC to copy, rename or delete files, or to format new disks if your PC is equipped with an appropriate floppy disk drive. (See Chapter 9, "User Hardware Specifications" for more details.)

Chapter 4

State Clocks



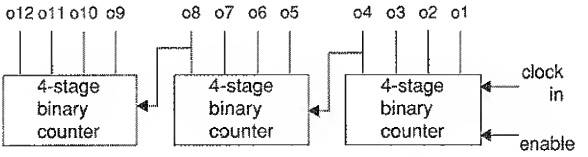
Clock Qualification

Clock-qualifiers allow you to selectively enable clock pulses on the wanted sample instants to avoid irrelevant data in the Logic Analyzer memory and on the screen.

Figure (a) on the next page shows a timing diagram indicating the Analyzer sample instants derived from the external clock shown on the upper line in this figure. The same data is sampled more than once by the analyzer. It is assumed that the falling edge of the clock was selected for data sampling.

Figure (b) shows the Analyzer sample instants derived from the same external clock. This clock is now qualified by a separate signal. In this diagram, the clock is enabled if the qualifier signal is high. The same data is now only sampled once by the analyzer.

A 12-stage binary counter is controlled by two signals: a clock signal (clock-in) and a active high count enable signal (enable). The clock is running continuously, however, the outputs of the counter will only change if the count enable signal is active (high).



If the clock signal is used by the analyzer without further qualification, a large number of equivalent samples may result, depending on the activity of the count enable signal.

Qualification of the clock signal by means of the count enable signal will result in a clock for the analyzer which is only active if the count enable signal is active (high). This prevents the analyzer from sampling the same counter value repeatedly.

The state clock expression for the Logic Analyzer should thus be:

State Clock = clock in $\downarrow$ • enable $^{-}$

Specifying Clock Qualifiers

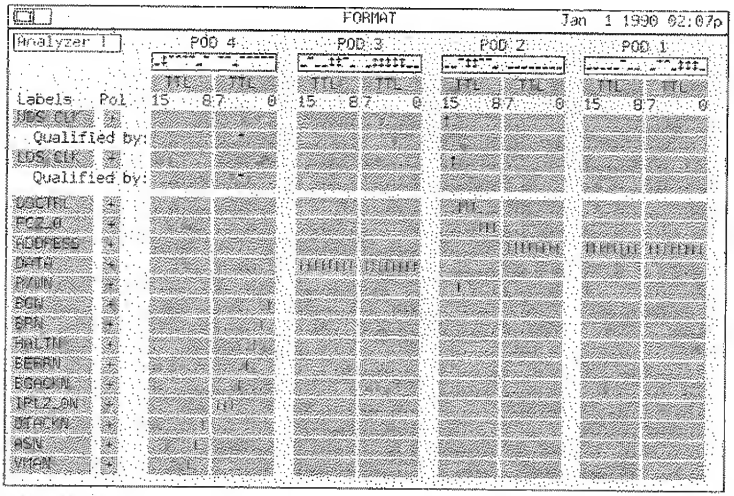
The specification of clock qualifiers is also done on the Format menu in the State clock definition area. For our example this is shown on the next page.

The UDSN and LDSN signal are only meaningful (i.e. indicate a bus transfer to or from the microprocessor) if the microprocessor has control over the busses. This is indicated by the status of the Bus Grant Acknowledge signal (BGACKN) of the microprocessor. In order to capture only meaningful states of the processor's busses the UDSN and LDSN signals should therefore be qualified by the BGACKN signal of the microprocessor.

The state clock expression for the Logic Analyzer should thus be:

$$\text{State Clock} = \text{UDSN}\uparrow \cdot \overline{\text{BGACKN}} + \text{LDSN}\uparrow \cdot \overline{\text{BGACKN}}$$

This expression can be defined on the Format menu in the State clock definition area as shown below.

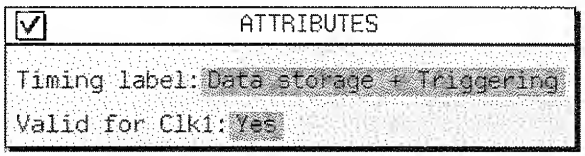


When an external clock occurs, the Logic Analyzer takes a sample of all the signals of all the pods assigned to that analyzer.

If more than one external clock is defined it may, however, be that only some signals are valid for one clock while other signals are valid for another clock. For example, sometimes it is needed for a microprocessor to use one clock at which only the address lines are valid and another clock for which only the data lines are valid. In order to get a proper display of the data captured the analyzer should only display the values sampled for those signals which were actually valid for the clock which caused the sample to be captured. For that it is necessary to tell the analyzer which signals are actually valid for which clock.

Label Attributes Menu

This can be done by means of *label attributes* which can be defined in the label attributes menu. This menu is accessed by pressing *SELECT* on the label field in the Format menu. The menu for the label is then popped up. By pressing *SELECT* on the *Attribute* field in this menu, the attributes menu is popped up (compare, Chapter 3, "Menu Overview": "Clock and Label Attributes".)



Valid for Clock

In the *Valid for Clki* field it can be specified whether a label is valid or invalid for that specific clock.

On displaying the state data the analyzer will show the samples in the order they were captured, with one sample

"Trace Control": "State Pattern Recognizers".

Timing Label

The other attribute found on the label attributes menu is *Timing label.* The purpose of this attribute is extensively described in Chapter 3, "Menu Overview": "Clock and Label Attributes".

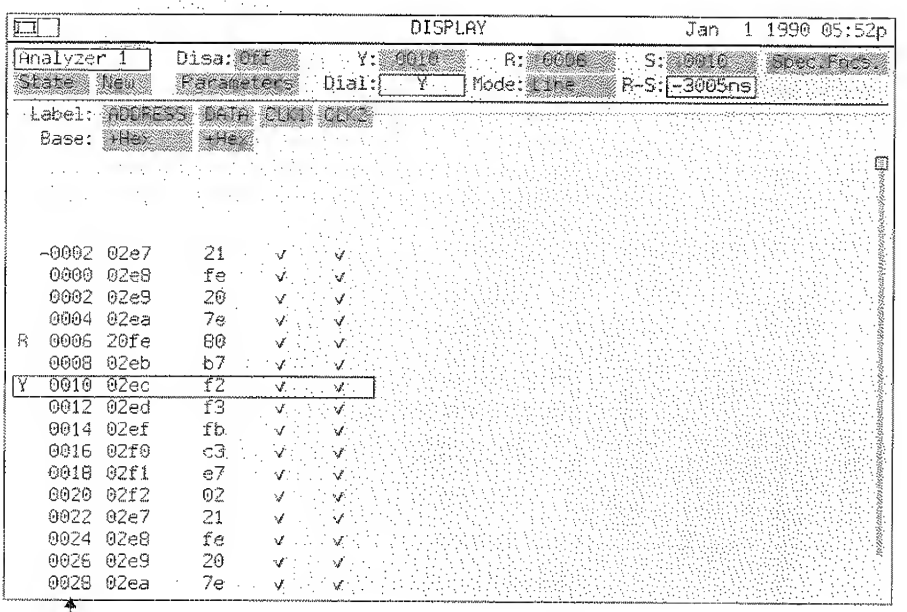
Default Values

When you insert a new label, the attributes for this label are set to their default values, i.e.:

Timing label : Data Storage + Triggering

Valid for Clki : Yes (for all clocks)

Specifically note that if a new clock (e.g. Clkx) is inserted, the *Valid for Clkx* attribute for all labels already defined is set to "Yes".



Sample number

Notes:

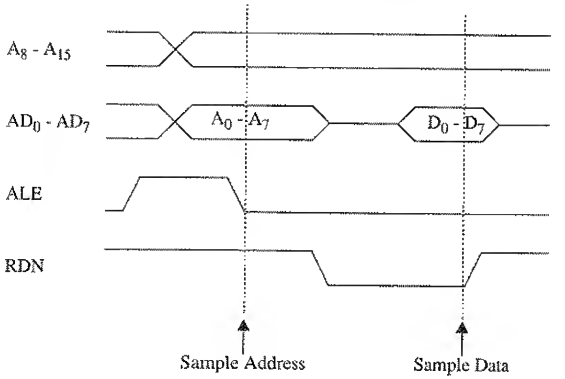
1. Two or more ticks (✔) on one line indicate that the samples on that line result from different clocks.
2. The sample number (or time value) displayed on a line containing more than one tick (✔) is that of the "first clock", that is of the clock specified in the *display on same line* as field.

Qualifier(s)

If a state clock does not require separate qualification, the *Qualified by* line on the Format menu is empty and thus actually irrelevant to show. You can therefore switch off the

Consider the 8085 microprocessor from Intel. This processor has a multiplexed address/data bus where the least significant address lines are multiplexed with the data bus.

The timing diagram for a read cycle is shown below:

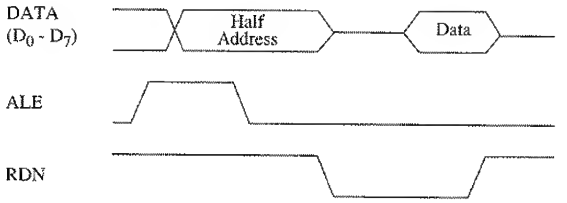


The timing diagram for a write cycle and interrupt acknowledge cycle are equivalent.

The multiplexed address/data lines (AD_0 - AD_7) contain a stable address on the falling edge of the ALE signal. This signal should therefore be used to clock the address signals.

The address/data lines contain stable data on the rising edge of the RDN, WRN or INTAN signals as appropriate for the data transfer cycle. These signals should therefore be used to clock the data signals into the analyzer.

The four clock signals (ALE, RDN, WRN and INTAN) are only meaningful (i.e. indicate a bus transfer to or from the microprocessor) if the microprocessor has control over the busses. This is indicated by the status of the Hold Acknowledge signal (HLDA) of the microprocessor. In order to capture only meaningful states of the processor's busses, the four clock signals should therefore be qualified by the HLDA signal of the microprocessor.



Where, for each of the indicated time instants, signal changes occur in the label "ADDRESS" for the following reasons:

1. "ADDRESS" changes because the multiplexed address/data bus changes from address to floating.
2. "ADDRESS" changes because the multiplexed address/data bus changes from floating to data.
3. "ADDRESS" changes because the multiplexed address/data bus changes from data to floating.

For the label "DATA", half of the address and all data would be shown. Although this is correct, the label name "DATA" would not properly reflect this.

The timing display would thus be very confusing. It is therefore necessary to explicitly tell the analyzer that the labels "ADDRESS" and "DATA" are to be used for state analysis only. Two other labels "AD7_0" and "A15_8" should be specified, and used for timing analysis only.

The Timing label attribute for the labels "ADDRESS" and "DATA" should thus be set to "No".

The Timing label attribute for the labels "AD7_0" and "A15_8" should be set to "Yes", *i.e.*, "Data storage + Triggering".

For these last two labels it should be specified that they are not valid for any of the state clocks; i.e., Valid for ALE, RDN, WRN, INTAN = "No".

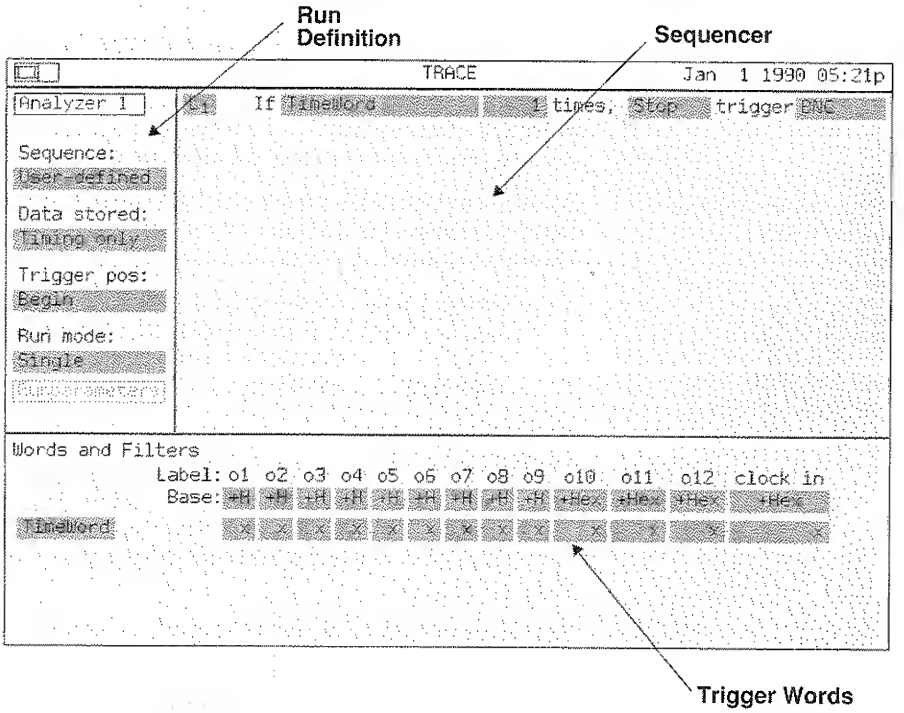
The following table summarizes the attributes for all the labels of the 8085 as set by the setup files provided with the

Trace Control

Basically you can control:

- What kind of data should be stored.
- When data acquisition should stop (triggering).
- What the trigger position should be.
- Whether a run should be automatically repeated or not.

All trace features are combined in the Trace menu.



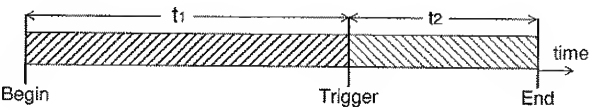
The *PM 3580/PM3585 Reference Guide* describes extensively how to set up and modify the menu. This chapter provides the background information for the menu.

Triggering of the logic analyzer is based on the recognition of a sequence of one or more specific data patterns in the data captured by the analyzer. Your logic analyzer has built-in a number of pattern recognizers (trigger words) for recognition of state and timing patterns (see "Pattern Recognition" beginning on page 5-7). Patterns can be specified in the Trigger words area of the Trace menu.

Thanks to the Dual Analysis Per Pin architecture, the analyzer can search for state and timing patterns in parallel. Both state and timing patterns can be specified within one single sequence (see "Sequencer Facilities" beginning on page 5-22).

Trigger Point Position

Considering the data stored during a run, two periods can be distinguished: that before the trigger point, and that after the trigger point. The diagram below shows this graphically.



You define by the sequence what the conditions must be for the trigger to occur, and by the Trigger Position, the relationship between t_1 and t_2.

Pre-trigger Period

During the pre-trigger period t_1, data is stored and a sequence of data patterns is searched for. If the sequence is not found before the memory fills, old data is pushed from memory, and new data inserted so the newest data is always available. When the sequence is found, the hardware is triggered.

For timing pattern recognition, the following recognizers are available:

- One timing word.
- Two filter words.
- One glitch detector.
- One edge detector.

For state pattern recognition, the available recognizers are:

- Eight state words.
- One range detector.

Each of these recognizers is described below.

Timing Pattern Recognizers

Timing Words

Each timing word is the AND combination of bit (0,1 or x) patterns in each label.

Three timing words are available per analyzer:

TimeWord: If specified, all timing samples captured are compared against the TimeWord.

tw_7,tw_8: If specified, all timing samples captured at 20 ns intervals are compared against tw_7 or tw_8 or both.

Note: tw_7 and tw_8 may alternatively be used as state words sw_7 and sw_8 respectively.

Timing Pattern Duration

For timing words tw_7 and tw_8, a pattern duration (filter) can be specified, allowing recognition of patterns which are present for more than or less than a specified time period.

The time period can be specified in a range from 20 ns to 1.31 ms in steps of 20 ns.

nels for which glitch triggering is specified. If glitch triggering is not specified, but the *Data Stored* field indicates that glitch data should be stored, then glitch data is stored for all channels.

Edge Detector

You can specify a rising edge (↑), a falling edge (↓) or either edge (↕) per channel. When an edge is specified on more than one channel, the analyzer logically ORs them together. That is, an edge pattern is found when an edge occurs on at least one of the channels you specified.

The analyzer may be programmed to look for an isolated edge, or for one during a pattern which has been present for at least a specified time. In the latter case, this is defined as:

$$\text{Edge during } (tw_i > t_i) \quad (i = 7 \text{ or } 8)$$

This condition is true if any edge specified occurs after time interval t_i, but before or at the moment when tw_i becomes false. That is, if any edge specified occurs within the time interval t_e shown below:

Note that glitch and edge patterns may be specified together in combination with a pattern duration, that is:

$$\text{(Glitch or Edge) during } (tw_i > t_i).$$

Note: The PM 3580/30 and PM 3580/60 instruments store data sampled at 100 MHz. However, edge detection in these units operates at 200 MHz. Consequently, if a pulse occurs which is smaller than the minimum detectable pulse for these units, triggering on the edge of such a pulse may occur, even if that pulse data is not stored.

Not state words are the same as state words, except that they are true if the sample captured *does not* match the state word specified.

Immediate State Words

State words may be combined into immediate word pairs labeled sw_{12}, sw_{34}, sw_{56}, sw_{78}. An immediate word pair sw_{xy} reveals a true condition if the state words sw_x and sw_y are recognized in two consecutive state samples, with sw_x being the first recognized.

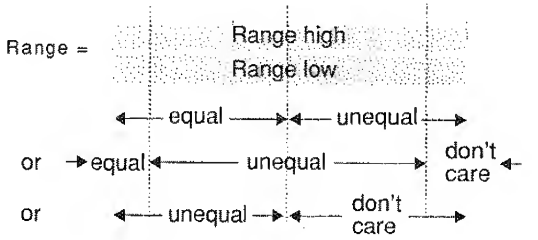
Applications

Applications which require the use of immediate state words are given in the examples "One Immediate Sequence of Two Patterns" on page 5-32 and "Two Immediate Sequences of Two Patterns" on page 5-33.

Multiplexed Busses

Immediate state words are also useful in analyzing multiplexed busses. As an example, consider a multiplexed address/data bus where the address is valid for Clk1, and the data is valid for Clk2. Recognition of an address/data combination in this case requires two state words, one to recognize the address, and the other the recognize the data. If sw_1 and sw_2 are programmed to be valid for Clk1 and Clk2 respectively, the immediate word pair sw_{12} may be used to recognize an address/data combination on the multiplexed address/data bus.

Note that for this particular example, the use of an immediate word pair is practical, but not absolutely necessary. The detection of the address/data combination could also be done by using two levels of the sequencer. The first level then looks for the occurrence of sw_1, the next level for the occurrence of sw_2 and if sw_2 does not occur, jumps back to the first level to look for sw_1 again.



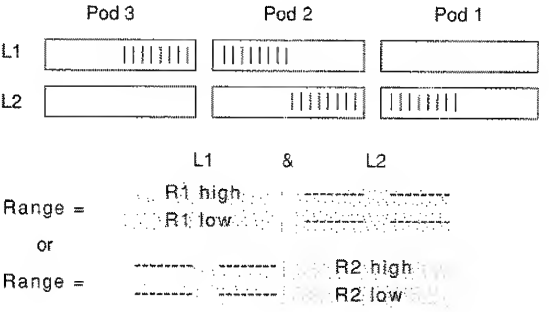
Note: Pod 4 not used by L32.

If a range is specified for L32 where range high and low for the channels of pods 2 and 1 differ, then the values for range high and low must be equal for the channels of pods 5 and 3. Alternatively, set pod 1 as don't care and the range can then be specified over pods 2 and 3. (Lose accuracy to extend range.) The values for range high and low must then be equal for the channels of pod 5. Similarly, if all channels of both pods 2 and 1 are set to don't care, a range may be specified for both pods 5 and 3.

Multiple Labels

When two or more labels share a pod, then, at any one time, only one of those labels can have a range specified for it. The label for which the range is specified is freely selectable.

The example below shows which range expressions can be defined for two different labels which share a pod:



tency is detected, you are notified via a popup menu, and you can select how the software resolves the inconsistency. You have a choice of:

- undoing the last value entered,
- updating this label only (RangeH = RangeL),
- updating all other labels as necessary.

Note that the second option is shown only if such an action can resolve the inconsistency.

Not in Range Detector

The "Not in range detector" is the inverted output of the range detector. So for example:

$$\overline{\text{Range}} = \text{not}\,\{(\text{Address in address range}) \cdot (\text{Data in data range})\}$$
$$= \overline{(\text{Address in address range})} + \overline{(\text{Data in data range})}$$

Not in range identifies label data which is numerically neither between nor on two specified patterns RangeH and RangeL.

Note that not in range is only evaluated for the state samples captured with the state clock specified for the range in the Trace menu's Trigger Words area.

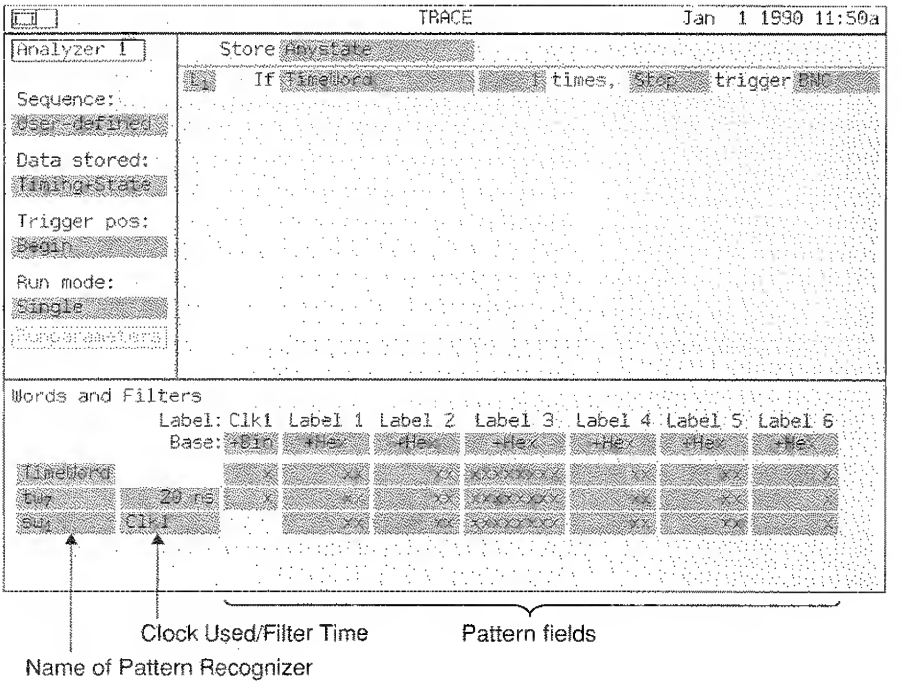
State Clocks

State Clocks may also be used as patterns themselves for both triggering as well as storage qualification. When state clocks are referred to, the edge definition and clock qualification as specified in the Format menu is used.

The patterns you want to be recognized by the analyzer during acquisition are specified in the Trigger Words area of the Trace menu.

Recognizer Fields

A row in this area represents a pattern recognizer. Pattern recognizers are automatically added to the Trigger Words area as predefined sequences are selected or conditions are specified in the Sequencer area. You can also insert and delete pattern recognizers in the Trigger Words area by pressing the *INSERT* or *DELETE* key respectively on any field of a row representing a pattern recognizer.



Triggering" or "Triggering only".

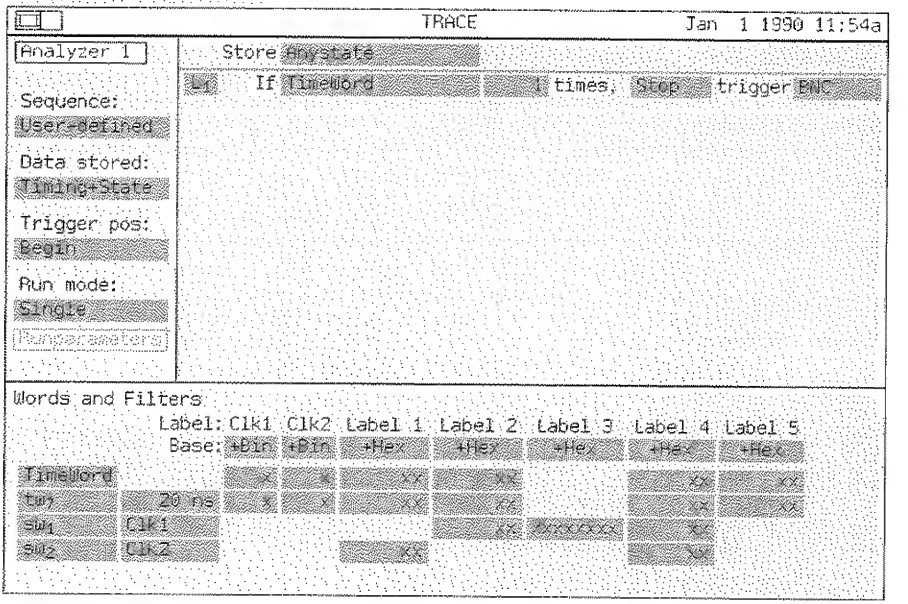
State Pattern Recognizers:

A pattern field is present for a label if the label is valid for the state clock for which the state recognizer is valid.

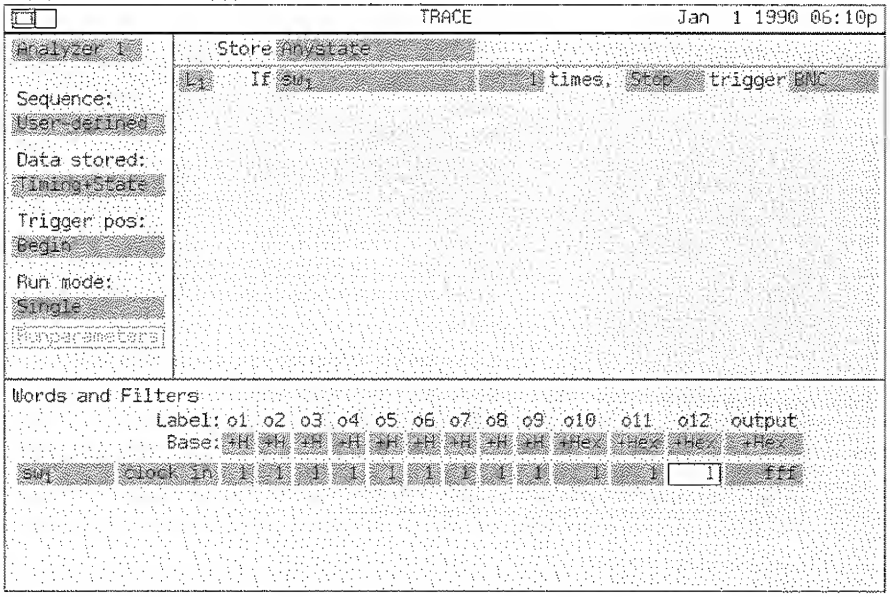
In the Trace menu shown below an example is given of a possible appearance of the Trigger Words area. In this example the labels have the following attributes:

	Timing Label	Valid for Clk1	Clk2
Label 1	Yes*	No	Yes
Label 2	Yes*	Yes	No
Label 3	No	Yes	No
Label 4	Yes*	Yes	Yes
Label 5	Yes*	No	No

* Either "Data storage + Triggering" or "Triggering only".



A channel may be present in different labels. You may change the value for such a channel in a pattern field of one of the labels. When you change the value, the pattern fields of the other labels which also contain this channel are automatically updated. As an example consider the Trace menu shown below. If you change for example the value for "o1", the pattern field for "output" is updated accordingly.



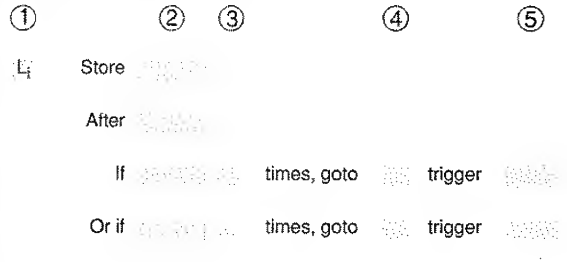
Ranges

For the range detector, two rows are available. The upper row (RangeH) allows you the specify the upper parts of the ranges for the labels. The lower row (RangeL) allows you to specify the lower parts of the ranges for the labels. See also "Range Detector" beginning on page 5-12.

The sequencer can have a maximum of eight levels. Each of these levels can independently have its own structure, ranging from simple to complex.

The simplest level construct is:

While the most complex is:



In the level construct, five different columns are distinguished as indicated above. These are:

1 Level number:

Shows which level is concerned, acts as a label to branch to, and allows you to select level options.

2 Condition:

Store: Specifies what state data should be stored. The storage condition may be any combination of state pattern recognizers.

After: Specifies whether the sequencer must be suspended until either the other analyzer (on PM 3585) or BNC has provided a signal.

Trigger

The ***trigger*** field is simply attached to the *If* or *Or If* lines by selecting the trigger option on the Level options popup menu for the level. This popup is accessed by pressing *SELECT* while on the *level* field.

Deselecting the trigger option for this level on the popup menu removes the *trigger* field from the level construct.

After

The ***After*** line is simply added to the level structure by selecting the After option on the level options popup menu for the level. This popup is accessed by pressing *SELECT* while on the *level* field.

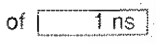
Deselecting the After option for this level on the popup menu removes the *After* line from the level construct.

Store

The ***Store*** line cannot be added separately per level. Instead, this line is automatically present in the structure of a level if you set the global store condition to "Per Level". This global store condition is displayed on a separate line above the sequence when you instruct the analyzer to store state data by setting the *Data Stored* field in the Trace menu to either "State only" or "Timing + State".

Note: If you do selective data acquisition, the trigger word which causes the triggering of the state section (either via *stop* or *trigger state*) is only stored in memory if this trigger word is also specified in the store condition.

Time-Out Value



The Time-out option in the *If* and *Or If* fields allows a branch to be performed after a certain amount of delay.

When you select time-out, the times expression changes to the field shown at left. The time-out value field is real numeric, 40 ns through the maximum time-out value, in steps of 20 ns with a default of 40 ns. If the occurrence of the Time-out condition leads to a sequencer stop (*i.e., Goto*

Note that calling Procedure B from within procedure A is conditional, so may be skipped, as indicated by the curved arrow. The same applies to the calling of procedure Test from within procedure B.

Using these state words, the sequence to detect this program flow and trigger on it is:

L1	If	sw_1	1	times, goto	L2
L2	If	sw_3	1	times, goto	L3
	Or if	sw_2	1	times, goto	L1
L3	If	sw_5	1	times,	Stop
	Or if	sw_4	1	times, goto	L2

In level 1, the sequencer waits until procedure A (sw_1) has been called, and then goes to level 2.

In level 2, the sequencer waits until either procedure B has been called (sw_3) or procedure A is ended (sw_2). If procedure A has been left, the sequencer returns to level 1, again waiting until procedure A is called. If procedure B has been called, the sequencer progresses to level 3.

At the third level the sequencer waits until either procedure Test has been called (sw_5) or procedure B has been ended (sw_4). If procedure B has been left, the sequencer returns to level 2.

If procedure Test has been called, the sequencer stops and triggers the acquisition hardware. Using the trigger position facilities (*Trig Pos* field in the Run Definition area), you can opt to store a specific amount of samples after the trigger before acquisition is completely stopped. (See "Trigger Point Position" beginning on page 5-5.)

In this example the analyzer is used to check if the pulse width of a signal is always large enough.

t_{min} = minimum pulse width

The sequence is:

L_1	If	$tw_7 \leq t7$	1	times,	Stop

Where t_7 is defined such that $t_7 = t_{min}$. If the pulse width is less than, or equal to t_{min}, the analyzer will trigger.

Check Maximum Pulse Width

This example checks if the pulse width of a signal is not too long.

t_{max} = maximum pulse width

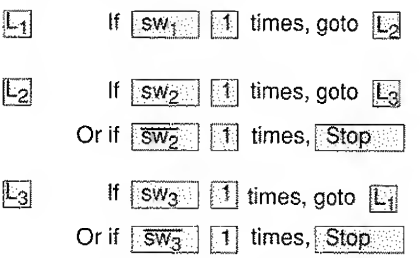
The sequence is:

L_1	If	$tw_7 > t7$	1	times,	Stop

Where t_7 is defined such that $t_7 = t_{max}$. The analyzer now triggers if the pulse width is greater than t_{max}.

The sequence below can be used to check if three patterns always occurs in the proper order. If the sequence is interrupted (sequence break) the analyzer triggers. Words sw_1, sw_2 and sw_3 are programmed to respectively match the first, second and third pattern of the pattern sequence to be verified.

The sequence is:



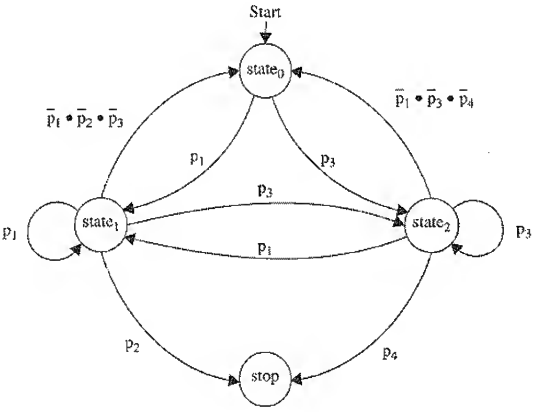
After the first pattern has been detected, it is checked whether the next two samples match the second and third patterns. If this is not the case, the sequencer stops and acquisition hardware is triggered. Otherwise the sequencer goes to level 1 and starts the search for the first pattern again.

Wait for a Pattern Sequence

In this example, a sequence is defined such that the analyzer will wait until three patterns occur in a specific order. The pattern sequence is always preceded by a pattern not occurring in the sequence. Words sw_1, sw_2 and sw_3 are programmed to respectively match the first, second and third pattern of the pattern sequence to be verified.

In this example we will use the analyzer to detect the occurrence of an immediate sequence of patterns p_1 and p_2, or an immediate sequence of patterns p_3 and p_4 in a long sequence of patterns sampled. All patterns are valid for the same state clock.

Proper detection requires the analyzer to keep track of the patterns according to the following state diagram:



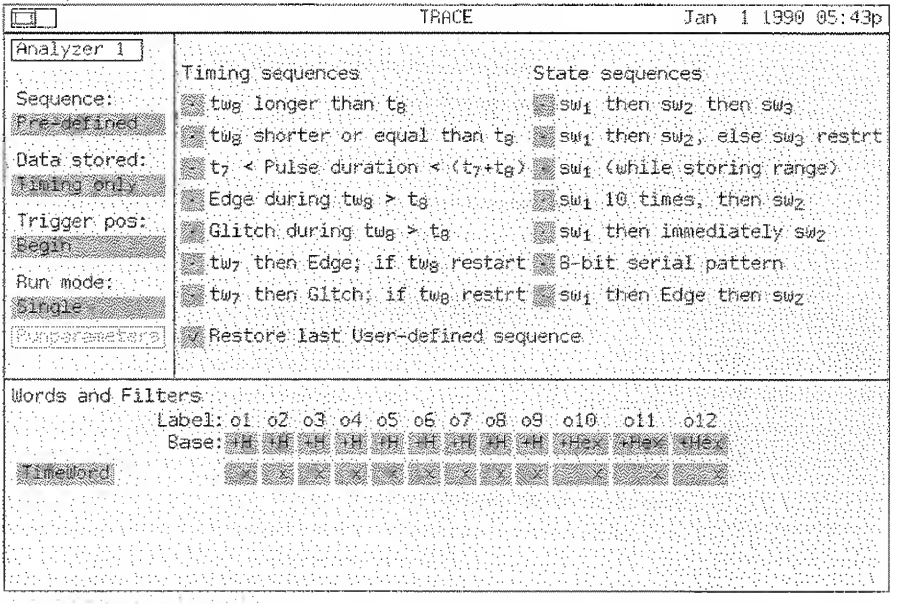
Words sw_1 - sw_4 are programmed to respectively match p_1 - p_4. Use of immediate state word pairs sw_{12} and sw_{34} as in the sequence below, allows the analyzer to trigger as required.

The sequence is:

L_1	If	$sw_{12} + sw_{34}$	1	times,	Stop	

Predefined sequences in many cases will provide you with just the options you require. They can also be used as a basis for your own definitions.

This is the predefined sequences Trace menu:



The default sequence is "Restore last User-defined sequence", and the default user-defined sequence is:

L1 If TimeWord 1 times, Stop trigger BNC

This means that the analyzer will sample and store data until the trigger condition (TimeWord) is met.

And in the Trigger words area is shown:

TimeWord X X X X ...

which means that *any* bit pattern matches. Thus the trigger is found immediately we begin sampling.

The State sequences are as follows. Except for the third sequence (store range) all state data is stored:

sw_1 then sw_2 then sw_3
Triggers on a sequence of three state words, one occurring after the other.

sw_1 then sw_2, else sw_3 restart
Triggers on the sequence of two state words (sw_1 and sw_2), provided that sw_3 does not occur before sw_2.

sw_1 (while storing Range)
Triggers on one state word and limits the data stored.

sw_1 10 times then sw_2
Triggers on one state word after another state word has been detected 10 times.

sw_1 then immediately sw_2
Triggers if state words sw_1 and sw_2 are recognized in two consecutive samples, with sw_1 being the first recognized. Compare examples "One Immediate Sequence of Two Patterns" on page 5-32 and "Two Immediate Sequences of Two Patterns" on page 5-33.

8-bit serial pattern
Triggers when 8 state words follow each other in a specified order without a break. Compare the example "Check Pattern Sequence" beginning on page 5-31.

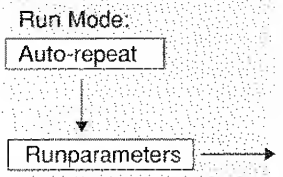
sw_1 then Edge then sw_2
Triggers on one state word followed by a change of state of one or more signals followed by another state word.

Explanations of the exact meaning of the terms in these sequences are to be found in the sections concerning pattern recognition beginning on page 5-7. They are also defined in the "Timing Sequences" and the "State Sequences" in the *PM 3580/PM 3585 Reference Guide.*

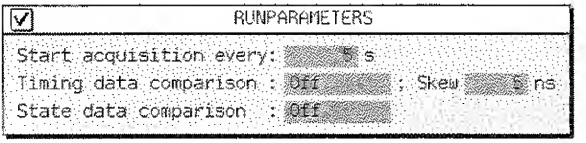
You can set up your analyzer to automatically restart itself after each non-manual acquisition stop. This is called the auto-repeat mode and can be selected in the Run Definition area of the Trace menu, in the *Run Mode* field.

Starting Repetitive Measurements

When auto-repeat mode has been selected, pressing the *RUN* key starts the analyzer. After the trigger condition has been detected and acquisition has stopped, the analyzer displays the data and then automatically restarts itself.



You can specify the amount of time between analyzer stop and automatic restart using the run parameters popup menu.



The value specified in the *Start acquisition every* field determines the amount of time between analyzer stop and automatic restart (5 sec. by default).

Terminating Repetitive Measurements

The automatic repeat can be terminated on the basis of data comparison results between newly acquired data and data stored in reference memory.

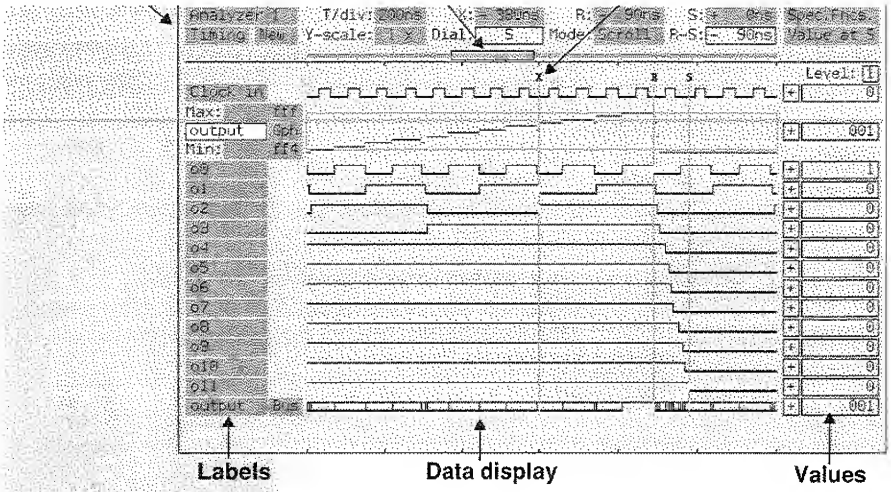
Data can be stored in reference memory by using the copy functions provided in the special functions popup menu of the display menu (see Chapter 3, "Menu Overview": "The Special Functions Popup Menu", and the "Display Special

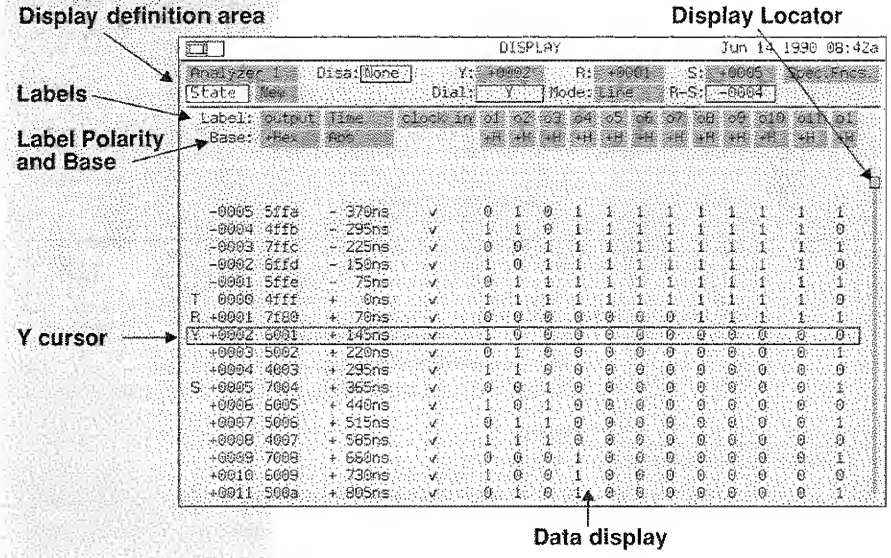
If the auto-repeat mode is selected (*Run mode* field is set to auto-repeat), a time counter is displayed on the menu bar immediately adjacent to the analyzer activity icons. If the auto-repeat mode is inactive, such as when the *RUN* key has not yet been pressed, or the auto-repeat is stopped, this time counter is displayed in *light gray*.

If the auto-repeat mode is active, the counter is displayed in *black and is counting down*. On reaching zero, an acquisition run is automatically started.

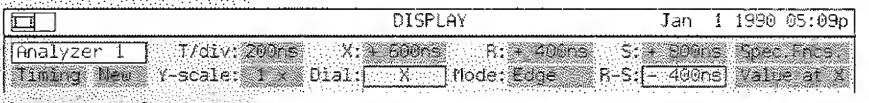
Chapter 6

Analyzing the Data


Labels
Data display
Values


Display definition area
Display Locator
Labels
Label Polarity and Base
Y cursor
Data display

You can select to display the data from any one of these sources using the three fields at the left-hand side of the display definition area.



Three fields to select the data source

- Analyzer Name — This field selects between data from Analyzer 1 or Analyzer 2. On PM 3580 instruments data for Analyzer 2 can only be selected if a measurement file has been loaded which was generated on a PM 3585 instrument.
- Data Type and Form — (Timing/State) This field selects between the display of timing data or state data and also the form of the display: waveform or list. (See below).
- Data Source — This field selects between the display of newly acquired data, (New), reference data (Ref) or the results of the comparison between New and Reference data (Comp).

The data shown on the menu the first time it is displayed, depends on whether data has already been acquired, and, if not, the setting of the *Data Stored* field on the Trace menu. Data is shown, for preference, from Analyzer 1, and state data is shown rather than timing.

In addition to memory for storage of newly acquired data your analyzer contains a separate memory in which reference data can be stored. Newly acquired data can be compared with this reference data.

Copying Data to the Reference memory

You can copy data to the reference memory by using the *Copy New to Reference* function field on the Display Special Functions popup menu. You can also use the *Exchange New and Reference* field.

Measurement File

If you saved a measurement to disk (using the Save command on the I/O menu) while reference data was defined, this reference data is also saved. If you load the measurement file (using the Load command on the I/O menu) the reference data will also be loaded.

Note: To make a Reference file for subsequent use you will save disk space and will be able to load faster if there is no New data. This will be the case if after acquiring a measurement you use "Exchange New and Reference" instead of "Copy New to Reference"

Data Comparison

Comparisons can be made between new and reference data on the Display menu by selecting "Comp" in the *Data Source* field of the display definition area.

Waveform Display

In the *Waveform display*, the data shown is the result of the comparison of New and Reference data using the exclusive-OR function. Differences between New and Reference data are displayed as high (1) and equalities as low (0).

List Display

In the *List display* New data is shown with the differences from the Reference data highlighted.

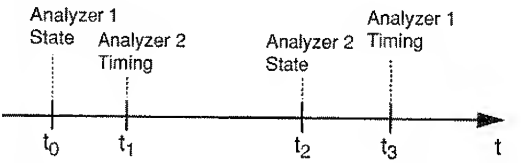
Repetitive Measurements

Data comparison can also be executed during *repetitive measurements*. The positions of the R and S cursors then determine which part of the measurement data is compared for autostop. (See Chapter 5, "Trace Control": "Repetitive Measurements").

During an acquisition, two analyzers may be active (only one for PM 3580 instruments) and for each analyzer, two independent sections (timing and state). By default, all sections are triggered simultaneously at T_0. However, each of the analyzers and each of its sections can be triggered at different instants. Consequently, four different (two for PM 3580 instruments) triggering instants may exist within a single measurement:

- Trigger for Analyzer 1, Timing.
- Trigger for Analyzer 1, State.
- Trigger for Analyzer 2, Timing (PM 3585 only).
- Trigger for Analyzer 2, State (PM 3585 only).

An example is shown in the figure below:



To properly correlate the data captured by the different sections one trigger instant is selected for references. This trigger instant is mapped to 0 and labelled T_0.

This time instant is selected as follows:

- If there is only one trigger point in memory, then that point is taken as T_0.
- If there is more than one trigger point in memory, then the trigger point with the earliest time is the time origin (in the example above this is the instant where the state section of Analyzer 1 was triggered).

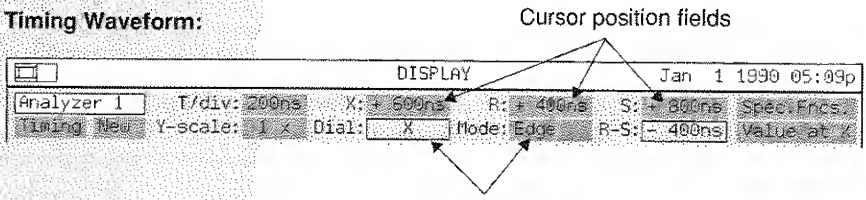
If there is no trigger point in memory (the trigger has been lost) then the oldest sample in memory is taken to be T_0.

In the Display menu, the dial is used to scroll through the measurement data and to set reference cursors (R and S).

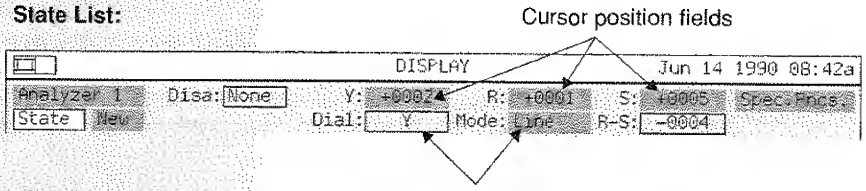
The dial can be operated in different modes. The dial mode, selected in the *Dial Mode* field, determines how much the element on which the dial currently operates (measurement data, R or S cursor) moves per click of the dial. For example each click may represent a movement of one or more pixels (step) or one line only or a whole page. For a complete overview see "Waveform Displays" beginning on page 6-18 and " List Displays" beginning on page 6-27.

For example:

Timing Waveform:



State List:



Dial Locking

On cursor position fields (X,Y,R,S), auto dial locking takes place. That is, if the dial is moved when any of these fields is highlighted, the dial is locked to that field. When any other field is highlighted and the dial is turned, the dial affects the cursor that was last locked.

point, press the +/– key to change the sign.

Depending on whether you were editing a sample or a time value proceed as follows.

If you were editing a *sample number*, press *SELECT*. This closes the popup. The screen is refreshed so that the sample value selected for X or Y is in the center of the display area.

If you were editing a *time value* and you want to change the units also, proceed as follows.

Use the right arrow key to move to the units field, then, either press the appropriate key or press *SELECT* to toggle through the options.

Units

The units you may select for a cursor position are:

n	nanoseconds
u	microseconds
m	milliseconds
s	seconds
k	kiloseconds

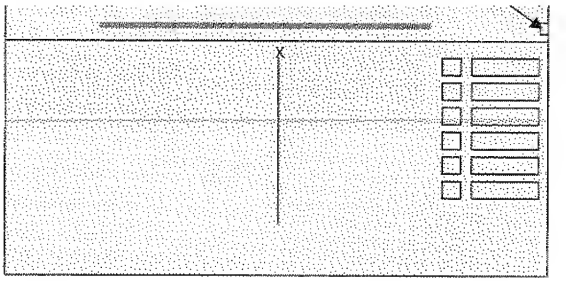
Finally close the popup by pressing *HOME* then *SELECT*, or *HOME* again. The screen is refreshed so that the time position selected for X or Y is in the center of the display area.

Quick Movement

You can also move the X or Y position to a predefined position quickly by pressing an appropriate alphabetic key, as shown in the box below.

Quick Movement Characters

B	Beginning of data	**S**	S position
C	Center of data	**T**	Trigger position
E	End of data	**X**	X position
R	R position	**Y**	Y position

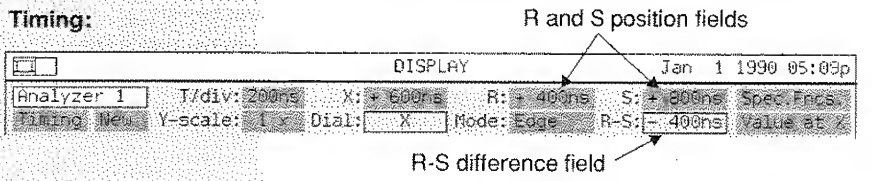


Measurements
(R and S cursors)

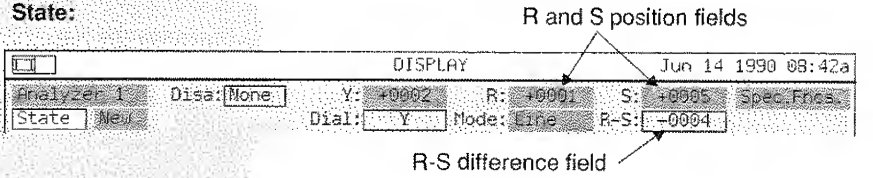
You can set the R and S cursors to measure differences between timing events (*e.g.*, the difference between edges on two different signals) or state events. The difference can be shown in time or sample numbers.

The position of these cursors is indicated in the display definition area. The value in these fields may be time or sample number (see "Time or Sample Numbers" on page 6-10). The difference between the R and S cursor positions can be read immediately from the *R-S* field.

Timing:



State:



The R and S cursors are also used to select the part of data that should be compared during repetitive measurements (see Chapter 5, "Trace Control": "Repetitive Measurements").

Adding Labels

To add a label, highlight the label after which you want the new label to be inserted, and press the *INSERT* key. A menu of all the available labels (as you defined them in the Format menu) appears. Highlight the label you want, and press either *SELECT* or *INSERT*. The label is now added to the display.

Use delete then add to move a label to a different position.

Note: You may add the same label more than once.

Changing Labels

To replace one label by another, highlight the label you want to change, and press *SELECT*. A menu of all the available labels (as you defined them in the Format menu) appears. Highlight the label you want to appear in place of the current label, and press *SELECT*. The label is now replaced by the one selected.

Quick Label Selection

You can also change a label using the first character select method: highlight the label to be changed and press the first letter of the label to replace it. If there is more than one label starting with the same letter, keep pressing the letter until the required label is shown.

Hint: To insert a label before the first label, insert (add) the first label (so it appears twice), then change the first label to the one you want.

Display of Sequencer Levels

In all displays you can see at which level the sequencer was when a particular data sample was captured.

In waveform displays this is shown at the top of the values area in the *Level* field (information field).

In list displays a special label called "Level" is available. This label can be added as described in subsection "Selecting Labels for Display" on page 6-16.

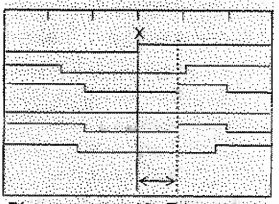
Note: An "S" (Stop level) is shown as value for the level for those samples which were captured after the trigger.

If the Dial Field shows *X*, then turning the dial causes the waveforms to move. The amount moved depends on what is set in the Mode field and whether the highlight is on a label (at the left of the screen) or in the display definition area (at the top of the screen). The mode field also applies when moving the R and S cursors. For X, the cursor remains in the center of the display and the *waveforms* move in the direction the dial is turned. For R and S cursors, the *cursors* move in the direction the dial is turned.

The available mode settings are:

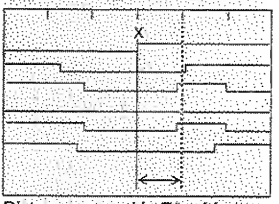
Step This mode is only for changing the X scaling (*T/div* or *S/div*). It is only available when the X scaling field is highlighted and does not appear on the mode popup. The Time or Sample number per division moves to the next or previous scale division per "click" (see "X-scale (T/div and S/div)" beginning on page 6-20).

Scroll The default for waveform displays. This mode allows very fine adjustment of the cursor. The waveforms or cursor move one or more pixels per "click".



Distance moved in Edge Mode

Edge Moves the waveforms or cursor such that the appropriate cursor is on the next edge (transition). If a label field is highlighted, then the dial moves the cursor from edge to edge of that label only. If any other field is highlighted, the dial moves the cursor to the edge of any label which is displayed.

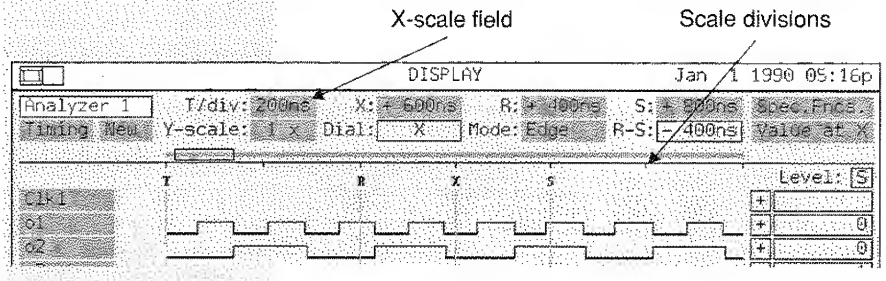


Distance moved in Div Mode

Division Moves the waveforms or cursor by one scale division (these are the marks below the display locator and at the bottom of the data display area). You can change the scale of these divisions: see "X-scale (T/div and S/div)" beginning on page 6-20.

Depending on the horizontal (X) scale set, a larger or smaller part of the total measurement is displayed. When first displaying newly acquired data, the Logic Analyzer sets the scale so that at least 10% of the total measurement is displayed.

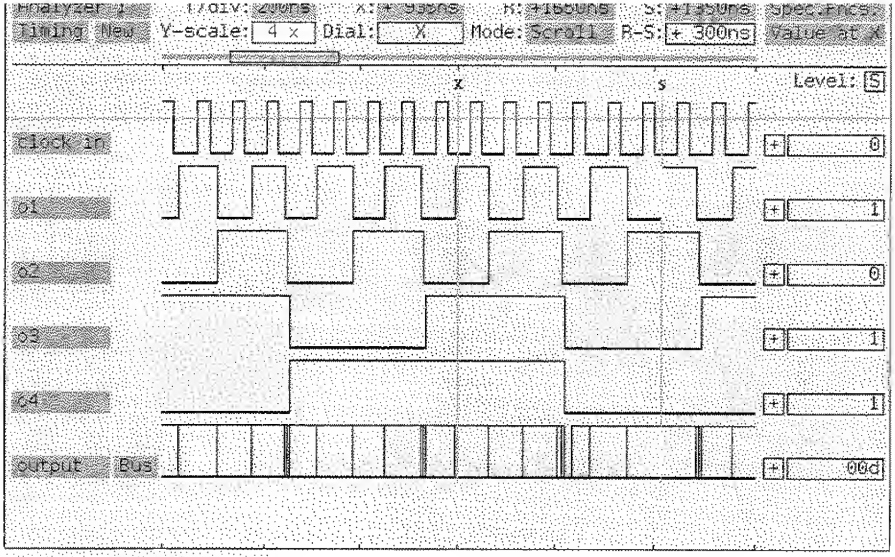
The horizontal dimension (X) of the data display is divided into six divisions as shown on the line below the display locator and at the bottom of the display. You select the



scale by specifying the number of units per division in the *X-scale (T/div* or *S/div)* field in the display definition area. Changing the X scale allows you to zoom in or out on the data around the X position.

The *X-scale* field shows *T/div* if the X, R and S fields show time values, or *S/div*, if they show sample numbers. You set the display to use time or sample numbers in the Special Functions menu (see "Time or Sample Numbers" on page 6-10) or you can use the pop-up menu which appear when you press *SELECT* on the X-scale field.

Note that "Sample" for timing data refers only to those samples in which a transition (high/low or low/high) has occurred on one or more analyzer channels which have been enabled for timing analysis in the *FORMAT* menu.



Bus Data

If more than one channel is connected to a label, by default, all signals of that label are shown together on the waveform display. The resulting waveform is the OR of each of the separate signals of the label. The figure above shows the effect. (Label "output").

The values field at the far right of the screen shows the hexadecimal value of the label at a specified cursor position (here it is "00d" under the X cursor). See "Label Values" on page 6-26 for more information.

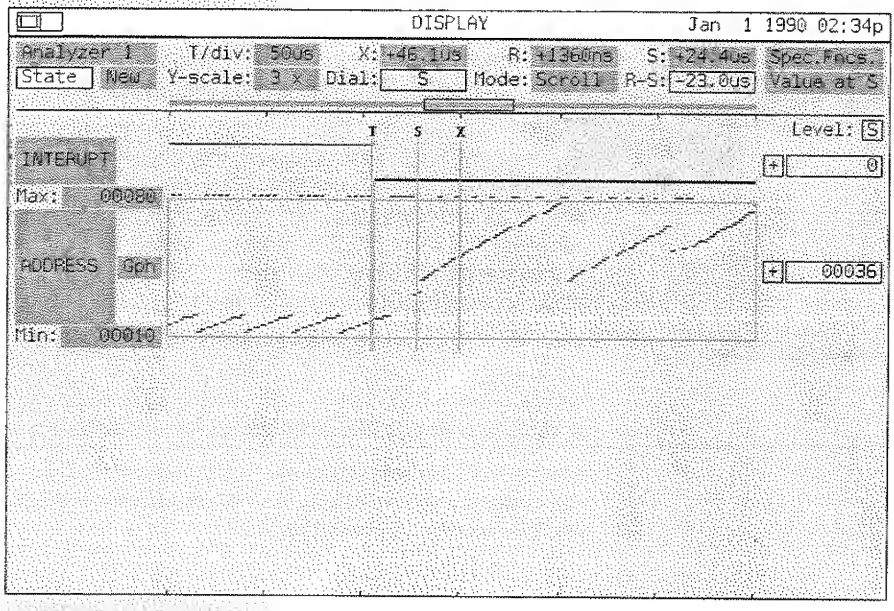
Individual bus signals

Instead of showing the whole bus, you can show just one signal. To do this, highlight the bus field, and either press *SELECT* to toggle through the signals of the bus, or use the numeric keys to enter the number of the channel you want to display. The *B* key selects all channels (Bus). The

You can also type in a value (or select Value from the pop-up, then type in the value).

Values of the bus that have the same value as the border value are shown on the border line. Those values which lie outside the border values are shown just outside the borders.

The following screen shows another application of the bus graph mode. This screen shows the execution of a program loop, an interrupt and the operation of the interrupt. The R (=T) and S cursors show the interrupt service delay time.

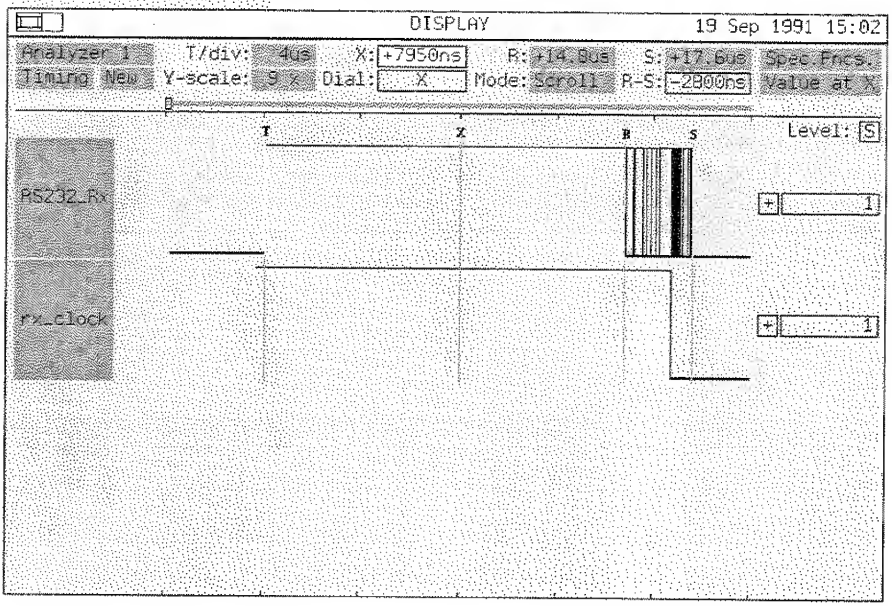


The graph mode can for example also be used to check the proper functioning of an analog-to-digital converter (ADC). Displaying the output signals of the ADC in graph mode will show the analog waveform that was converted by the ADC on the analyzer display.

You can enable waveform "accumulate mode" in the *Display Special Functions* menu (see page 6-8). If you set "Accumulate: On" then the waveforms displayed on the screen are not refreshed each time a new data set is acquired. The new data then overlays all the previously acquired data since accumulate mode was enabled.

You can typically use this to examine the stability of a set of timing signals. An unstable baudrate on a serial communication link can cause parity errors. Incoming bits (RS232-Rx) are sometimes missed by the internal receiver clock. The unstability rate can be traced over a period of time (R-S cursors). See example screen below.

Note that this is purely a bit-map function. The previously acquired data is not stored. So although you can at all times scroll the data on the screen, the data scrolling onto the screen will only be from the current acquisition, and will not be accumulated. If the picture is zoomed, the accumulated information is removed.



If the Dial Field shows *Y*, then turning the dial causes the list items to move. The amount moved depends on what is set in the Mode field and whether the highlight is on a label field (at the top of the list) or in the display definition area (at the top of the screen). The mode field also applies when moving the R and S cursors. For Y, the cursor remains in the center of the display and the *list items* move opposite to the direction the dial is turned. For R and S cursors, the *cursors* move in the direction the dial is turned. The available mode settings are:

Line Moves one line per "click". Clockwise is down, anti-clockwise is up.

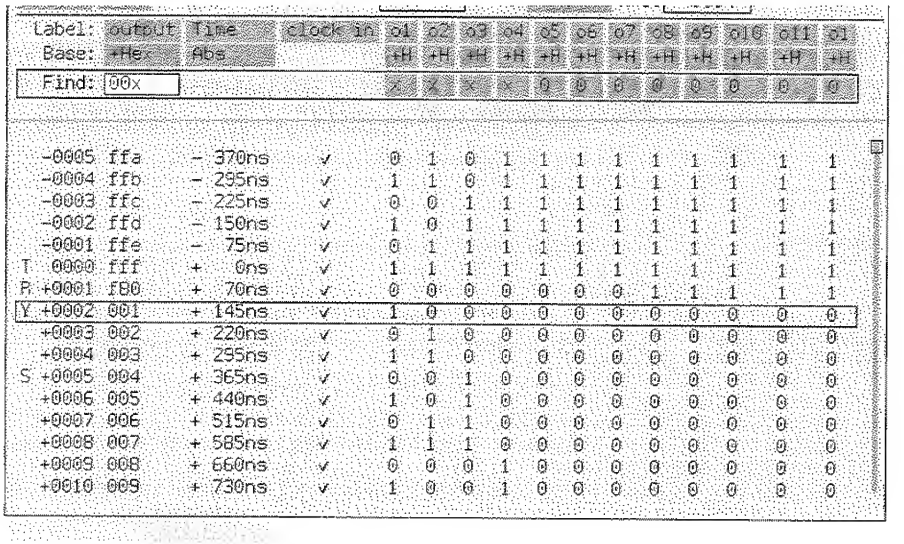
Page Moves one display page (the length of the data display) per "click".

Level Moves the cursor to the next (previous) sequence level transition. Not when Data Source field is *Compare.*

Find Moves the cursor to the next (or previous) occurrence of the selected word (see "The Find Function" on page 6-29).

Different Only when Data Source field is *Compare.* Moves the cursor from one difference between new and reference data to the next in the direction the dial is turned. If a label field is highlighted, then the dial moves the cursor from difference to difference in that label only. If any other field is highlighted, the dial moves the cursor to the next difference in any label displayed.

Equal Only when Data Source field is *Compare.* Moves the cursor from one equality of new and reference data to the next in the direction the dial is turned. If a label field is highlighted, then the dial moves the cursor from equality to equality in that label only. If any other field is highlighted, the dial moves the cursor to the next equality in any label displayed.



Label:	output	Time	clock in	o1	o2	o3	o4	o5	o6	o7	o8	o9	o10	o11	o1
Base:	+Hex	Abs		+H	+H	+H	+H	+H	+H	+H	+H	+H	+H	+H	+H
Find:	00x			x	x	x	x	0	0	0	0	0	0	0	0
-0005	ffa	- 370ns	v	0	1	0	1	1	1	1	1	1	1	1	1
-0004	ffb	- 295ns	v	1	1	0	1	1	1	1	1	1	1	1	1
-0003	ffc	- 225ns	v	0	0	1	1	1	1	1	1	1	1	1	1
-0002	ffd	- 150ns	v	1	0	1	1	1	1	1	1	1	1	1	1
-0001	ffe	- 75ns	v	0	1	1	1	1	1	1	1	1	1	1	1
T 0000	fff	+ 0ns	v	1	1	1	1	1	1	1	1	1	1	1	1
R +0001	f00	+ 70ns	v	0	0	0	0	0	0	0	1	1	1	1	1
Y +0002	001	+ 145ns	v	1	0	0	0	0	0	0	0	0	0	0	0
+0003	002	+ 220ns	v	0	1	0	0	0	0	0	0	0	0	0	0
+0004	003	+ 295ns	v	1	1	0	0	0	0	0	0	0	0	0	0
S +0005	004	+ 365ns	v	0	0	1	0	0	0	0	0	0	0	0	0
+0006	005	+ 440ns	v	1	0	1	0	0	0	0	0	0	0	0	0
+0007	006	+ 515ns	v	0	1	1	0	0	0	0	0	0	0	0	0
+0008	007	+ 585ns	v	1	1	1	0	0	0	0	0	0	0	0	0
+0009	008	+ 660ns	v	0	0	0	1	0	0	0	0	0	0	0	0
+0010	009	+ 730ns	v	1	0	0	1	0	0	0	0	0	0	0	0

"Time" Label

A special label, called "Time", is available in list displays. In this column, the time instant at which the sample was captured is shown. This time instant may be shown relative to the next sample (Base: Rel) or absolute with respect to T_0 (Base: Abs).

Notes:

1. If the samples displayed on a line originate from different clocks (due to the specification of "display on same line as" in the *"Label attributes"* menu) then the time value shown is that of the "first clock". That is, of the clock specified in the *display on same line as* field. (Compare Chapter 4, "State Clocks": "Display on Same Line as").
2. The "Time" label can be operated on as a normal data label. Thus it can be deleted, added, changed, etc. as described in "Selecting Labels for Display" beginning on page 6-16).

If a disassembler is loaded, the *Disa* field in the display definition area of the state list can be toggled to switch disassembly "On" or "Off". Furthermore, a *Disassembler parameters* field is added to the display definition area of the state list display. Using this field, a popup menu can be selected on which different disassembler parameters can be set. The parameters control which state samples are shown, and the disassembly process.

See "Disassembler Parameters Menu" in the *PM 3580/ PM 3585 Reference Guide* for more detailed information on disassembler parameters. See Chapter 7, "Disassemblers" for general information on disassemblers, and the appropriate microprocessor support documentation (supplied separately as an appendix of this manual) for specific information.

If disassembly is "On", a special label, "Processor instructions", is added to the state list display. The results of the disassembly are shown in this column.

Note that, if no disassembler is loaded, the *Disa* field shows "None" and is not selectable.

Disassembly is only available on state list displays. The *Disa* field does not appear in the header area of any other display.

New data will be shown either from the other analyzer or of a different type (state or timing) than that already shown. The next time a split screen is created the data type and form that was most recently "hidden" will again be displayed.

Deleting a Window

To delete a window of a split screen, go to the analyzer name field shown in that window and press the *DELETE* key. The complete screen is now again available for the remaining window.

Active Window

Only one window can be active at the same time (*i.e.*, the dial operates only on that window, unless Coscrolling is on). The currently active window is that window in which one of the selectable fields is highlighted.

As with all fields, you can use first letter select to position the cursors in the data. If you type, respectively, R or S on the R or S cursor fields the cursor value from the other window is set. Similarly in the special case when you have two of the same window type (waveform or list) typing X (or Y) on the X (or Y) cursor select field sets the corresponding value from the *other* window.

Moving Between Windows

You can move between the two windows by pressing the *DISPLAY* key.

You can also move between the two windows by using the up and down arrow keys as appropriate.

two acquired occurrences of a routine (separated in time) are to be correlated. You might be examining these two occurrences to see if the program flow was the same. Alternatively, you could compare ("New") data captured at a different speed with ("Ref") data captured at a different speed. For example if you want to test your circuit using a faster version of the microprocessor.

Although coscrolling on samples will typically be used with two state windows, it can also be used to compare timing patterns. For example, to see if an RS-232 serial bit stream contains the same information at 38.4 kbaud as at 19.2 kbaud.

Chapter 7

Disassemblers

Loading a Disassembler

Loading a disassembler into your logic analyzer is simple and straightforward.

Put the floppy disk with the appropriate disassembler in the floppy disk drive. (Disassembler files have names with the extension ".DIS".) Go to the Configuration menu and press *SELECT* on the field called "Option". A list appears on the screen showing all the disassemblers available on the floppy disk. Highlight the disassembler you want to be loaded and press *SELECT*.

The disassembler software and the associated setup are then loaded.

Disassembler Setup

After the disassembler has been loaded, it automatically configures the Logic Analyzer as required. That is, pods* are assigned if necessary, all label and clock assignments (including attributes) are made in the Format menu, and the Display menu is updated. As an example the Format menu as set up by the 68000 disassembler is shown on the next page.

As the disassembler is being loaded, it is checked whether sufficient resources (*e.g.*, pods, labels and clocks) are free. Furthermore, if you already had assigned clocks, labels or both to channels in the Format menu, you are asked whether these assignments should be deleted or left intact. If the number of the resulting free resources is sufficient, the disassembler is loaded. If not, you are notified, and the disassembler is not loaded, except as noted below.

* The disassembler does not require the pods assigned to the analyzer to be adjacent.

Instruction Mnemonics

Instruction mnemonics are displayed in capitals according to the specification of the processor's manufacturer. The mnemonics are shown with a suffix indicating the operand size. For these suffixes the following notation is used:

".B"	:	Byte
".W"	:	Word
".D" or ".L"	:	Double-Word or Long-Word

Note: For 8-bit microprocessors these suffixes are not necessary, so are not shown.

Operand Field

In the operand field of an instruction, the operands are displayed in the same order as specified by the manufacturer.

Operand Values

The operand values are shown according to the following rules:

Signed operand parts: shown as decimal numbers with sign.

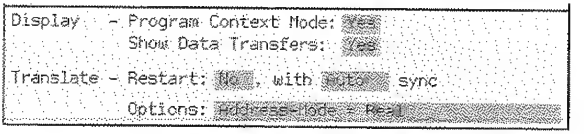
Unsigned operand parts: shown as hexadecimal numbers.

Immediate operands: are preceded by the "#" symbol.

Absolute long pointer addresses: are preceded by the "@" symbol.

Target Addresses

Target addresses for both conditional and unconditional program transfers (jumps, branches etc.) are calculated whenever possible. Addresses calculated by the disassembler are then shown as hexadecimal numbers enclosed in braces ("{" and "}"), and concatenated to the operand field.



The *Options* field is only present on this popup menu for those disassemblers which have additional options. This field is described, when appropriate, in the microprocessor support package documentation (appendices to this manual).

The fields on the Disassembler Parameters menu are grouped in two sections:

Display This controls which state samples are shown.

Translate This controls the disassembly process.

Display Options

The display options fields together determine which disassembled instructions are displayed.

Program Context Mode

The *Program Context Mode* field determines if the instructions are shown in raw mode or analyzed by the disassembler and displayed in context. If program context mode is chosen, the disassembler filters out irrelevant instructions and arranges instructions in the order they were executed.

Irrelevant instructions are those near program transfers (e.g., jumps or branches) or program exceptions, fetched but not executed, and those related to state samples captured with external clocks not defined by the disassembler.

The two Display menus on the next page show the output of the Disassembler with the *Program Context Mode* respectively on ("Yes") and off ("No").

croprocessor has a pipeline architecture, in Program Context Mode these samples are shown immediately following the instructions that caused them. The upper figure on the next page illustrates this also. Specifically look at the order of the sample numbers and the location of the data transfer samples shown (mr and mw).

Translation Options

The fields relating to translation are *Restart* and *Synchronization.*

Restart

Restart determines whether a new translation (disassembly) should be performed on the current measurement as soon as the disassembler parameters menu is closed.

Synchronization

The *Synchronization* field, and the other fields that may subsequently appear on that line, determine how the disassembler searches for proper instruction starting points.

Automatic Synchronization

For automatic synchronization, the disassembler starts at the earliest point in memory, and keeps correcting itself until a properly synchronized disassembly is achieved.

Manual Synchronization

For a manually synchronized disassembly, the disassembler starts at the instruction you set the Y cursor to.

You can define where on the bus the disassembler takes the starting point for disassembly using the *At Y* fields. This, however, only applies to microprocessors whose instructions can start at an address that is not a multiple of the data bus width. Each of the Xs in the *At Y* fields represents a nibble (4 bits). The number of Xs shown in each field depends on the minimum size the microprocessor uses to fetch opcodes. You toggle the field which is to be the starting point to show Xs. The other fields remain, or become, blank.

Chapter 8

Probing

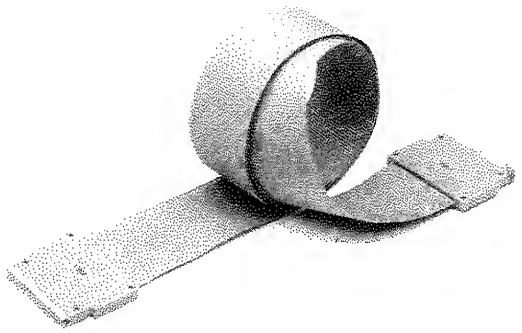
The probe impedance of the pod system depends on the type of front end used. Typical values for the probe impedance are:

Standard front end:	200 kΩ/7 pF
Microprocessor adapters:	200 kΩ/15 pF
RC connectors:	200 kΩ/7 pF (excluding traces on PCB.)

Pod Cable

The pod cable is a specially-designed cable. It carries sixteen signals in parallel plus two power lines (+5V, -5V) at each side of the cable (see chapter 9, "User Hardware Specification": "Pod Cable Connector"). The cable is fully symmetrical.

The connector housing has a location in which the pod number stickers supplied with your instrument fit.



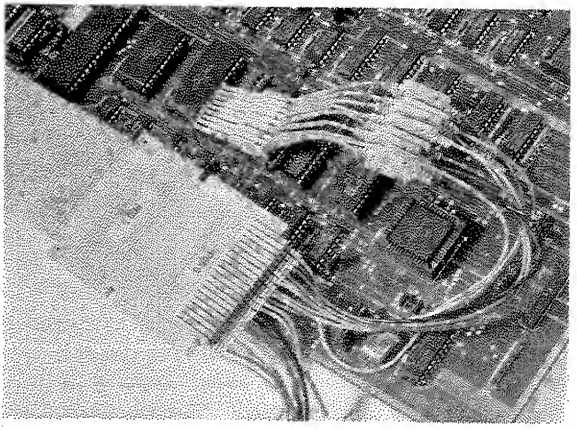
The best orientation for these stickers is with the bottom of the text closest to the cable (see photograph).

Keying Mechanism

The signal leads will not fit in the ground lead positions on the plug due to the built-in keying mechanism. The same keying mechanism prevents you from connecting leads to the +5V, -5V power lines on the cable.

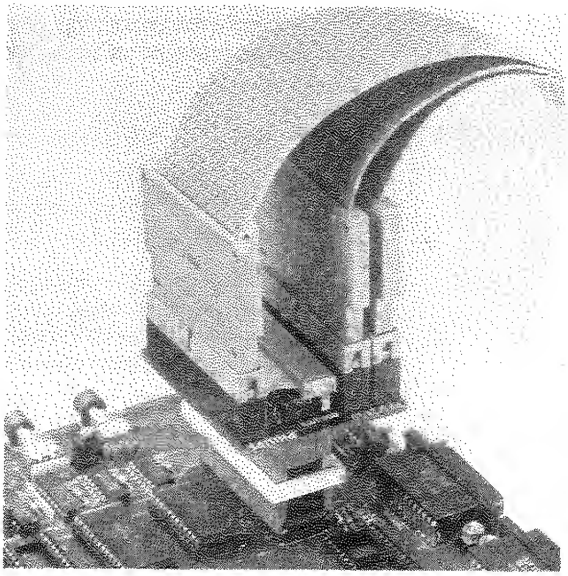
Connecting Leads to Signals

The leads can be connected to the signals you want to measure by means of the gray grabbers or red mini-clips supplied with your instrument.



You can also directly connect a lead to a wire wrap pin on your board or to the pins of a measuring clip.

The adapters contain special RC connectors to which the pod cables can be directly connected. The RC connectors contain the same RC compensation networks as the signal leads of the standard front end.



Adapter Types

Microprocessor adapters are available for DIP, PLCC, and PGA packages.

DIP

For the *DIP* packages, either a clip version (clip onto the chip), a socket version (insert between the microprocessor chip and its socket) or both are available. For the socket version extension sockets are separately available.

PGA and PLCC

PGA and *PLCC* versions are socket type. For these adapters, extension sockets are separately available.

Passive Adapters

The microprocessor adapters, whenever possible, have been designed such that both microprocessor state and

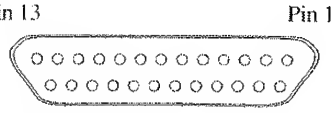
You can also incorporate the RC connectors as used on the microprocessor adapters in your own designs. You then mount the RC connectors directly on your boards.

The connectors, of course, require some board space. However, it is the most convenient way to probe your signals, since this solution creates the minimum adaption height and the most firm connection. The Logic Target, as described in the *Getting Started Guide* is one example of this type of probing.

The RC connectors can be separately purchased from your local Fluke/Philips sales representative, and come in sets of ten connectors (order number: PF 8603/20). These connectors are the same as the RC connectors used in the microprocessor adapters.

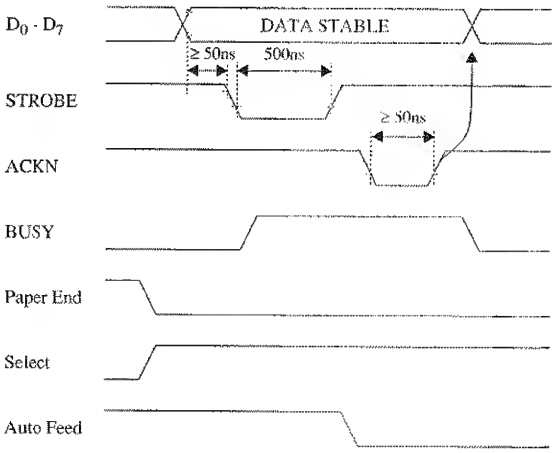
Chapter 9

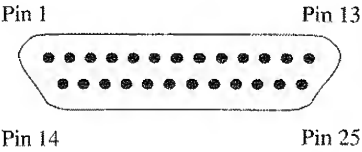
User Hardware Specifications



Pin	Signal	Pin	Signal
1	STROBE	10	ACKN
2	D0	11	BUSY
3	D1	12	Paper End
4	D2	13	Select
5	D3	14	Auto Feed
6	D4	15	not connected
7	D5	16	not connected
8	D6	17-25	GND
9	D7		

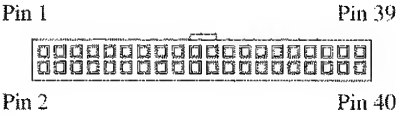
Timing Centronics Parallel Interface





Pin	Signal	Pin	Signal
1	GND	5	CTS
2	TX	6	not connected
3	RX	7	GND
4	RTS	8-25	not connected

RS232-C compatible



Pin	Signal
1	–5 V
2,4,6,..,38,40	GND
3	Data channel 0
5	Data channel 1
7	Data channel 2
9	Data channel 3
11	Data channel 4
13	Data channel 5
15	Data channel 6
17	Data channel 7
19, 21	GND
23	Data channel 8
25	Data channel 9
27	Data channel 10
29	Data channel 11
31	Data channel 12
33	Data channel 13
35	Data channel 14
37	Data channel 15
39	+5 V

Chapter 10

File Formats

LOGIC ANALYZERS
PM 3580 / PM 3585

Read the procedures for

Initial Inspection

Operator Safety

Installation

found on top of this documentation package **first**.

Then insert the description of these procedures as Chapter 11 after the "Safety and Installation" tab in the *PM 3580/PM 3585 User Manual*. You may then discard this page.

Chapter 11

Safety and Installation

Safety Precautions

The following subsections contain information, warnings and cautions which must be followed to ensure safe operation and to retain the instrument in a safe condition. Read these carefully before installation and use of the instrument.

Adjustment, maintenance and repair of the instrument shall only be carried out by qualified personnel.

Caution and Warning Statements

For the correct and safe use of this instrument it is essential that both operating and service personnel follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

Specific warning and caution statements, where they apply, will be found throughout the manuals.

Where necessary, the warning and caution statements and/or symbols are marked on the apparatus.

WARNING

Calls attention to a potential danger that requires correct procedures or practices in order to prevent personal injury.

CAUTION

Is used to indicate the correct operating and maintenance procedures in order to prevent damage to, or destruction of, the equipment or other property.

Note that the capacitors inside the instrument can hold their charge even if the instrument has been disconnected from all voltage sources.

Any adjustment, replacement, maintenance or repair of the powered-up, opened instrument shall be avoided as far as possible, and, if inevitable, shall be carried out only by a skilled person who is aware of the hazard involved.

WARNING

For any adjustment, maintenance, replacement or repair the procedures and additional safety instructions contained in the *PM 3580/PM 3585 Service Manual* must be adhered to.

Before plugging in the instrument make certain that it has been set to the local voltage.

Note: If the power plug has to be adapted to the local situation, such adaptation should only be done by a qualified technician.

WARNING

The instrument shall be disconnected from all voltage sources when a fuse is to be renewed, or when the instrument is to be adapted to a different line voltage.

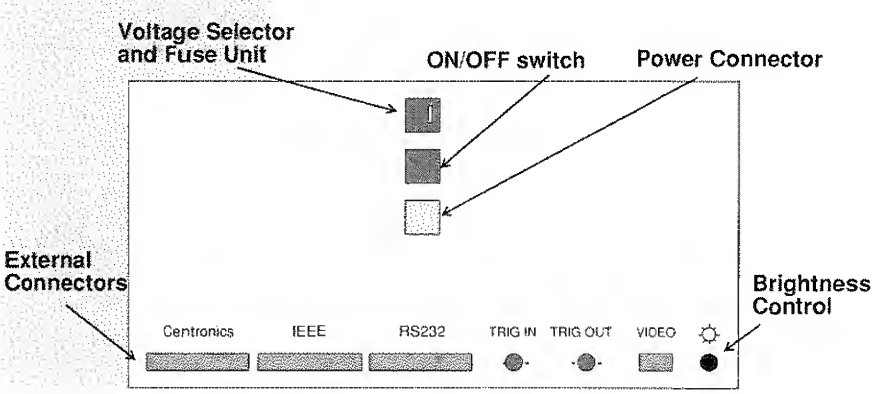
The two possible settings are 110 V (90 V - 135 V supplies) and 220 V (180 V - 264 V supplies).

Note

The correct fuse should be used for each of the voltage settings:

- 220 V: 2 A/250 V slow.
- 110 V: 4 A/250 V slow.

This setting is determined by the voltage selector unit located at the rear of the instrument: see the figure below.



Ensure that the instrument has been set to the local line voltage.

- Ensure that the power cable is not connected to the power supply and that the power switch on the instrument is OFF.
- Plug the female end of the power cable into the instrument.
- Plug the power cable into an appropriate **earthed** power source.
- Remove the transport protector (if any) from the floppy disk drive by pushing the eject button.
- Switch on the instrument. This will cause the light on the floppy drive to illuminate and a start-up message to appear on the screen.
- Push the System disk (PF 8690) into the drive until it locks.

Calibration

The system software is now loaded, including the autoload file if present. After loading a calibration procedure is executed. This procedure ensures that the propagation delay is the same on all channels.

After successful completion of the calibration, the Configuration menu is diplayed, and your system is ready for use.

Brightness Control

Adjust the brightness of the screen, using the control located at the rear of the instrument (see the figure on page 11-7), to suit your requirements.

Power on Self-Test

Note: If you press any key during the power on sequence of the analyzer, it will perform a (15 minute) self-test and display the results of the test on the screen. After the self-test has been completed and is satisfactory, you can proceed to use the instrument.

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Chapter 12

Utilities

A facility is available on the Utility disk to enable you to set the date and time, and the format of presentation, on the instrument.

After the procedure has been verified the date and time are stored in the RAM of the instrument and protected by the battery backup, therefore this procedure is not required every time the instrument is powered on.

The date and time can be set using the following procedure:

- Select the "Set date and time" utility from the utilities menu. The "Set date and time" popup menu appears.
- Move to the check field defining the time format required and press the *SELECT* key.
- Move to either the *Date* or *Time* field. These are normal editable fields (see Chapter 3, "Menu Overview": "Field Types"). Each part of the date and time (day, month, year, hour and minutes) must consist of two digits, so include leading zeros. The parts are separated by dots. The hours should always be entered in 24-hour format.

  You will not be able to leave a field if the entries you make in it are not valid.
- Exit this popup menu by selecting either the *return* or *cancel* field. If the *return* field is selected, the instrument will use the new date and time.

Microprocessor Support

Insert the documentation delivered with the Microprocessor support options in this section.

PROBLEM REPORTING / CHANGE REQUESTS

This PHILIPS instrument has been designed and manufactured to the highest quality standards to give you many years of trouble-free and accurate measurements.

However, if malfunctions are detected during the correct operational use of the instrument you are invited to report these problems to your local Fluke/Philips representative by means of the "PROBLEM REPORT / CHANGE REQUEST", reply cards included.

If you have any further suggestions about how this product could be improved, please contact your local Fluke/Philips representative.

Fluke/Philips addresses are listed in chapter 11 of this User Manual

LOGIC ANALYZERS

PM 3580 / PM 3585

JTAG / IEEE 1149.1 Boundary-Scan Protocol Analysis Package

PF 8683

Insert this document as an appendix of your PM 3580/PM 3585 User Manual.

Publication Number 4022 104 90771

Table of Contents

Introduction

The JTAG / IEEE 1149.1 Boundary-Scan Protocol Analysis Package consists of a:

- Boundary-Scan TAP Adapter.
- Boundary-Scan Disassembler.

The package is used in combination with the Philips PM 3580/PM 3585 Logic Analyzers. It allows simultaneous timing and state analysis of the signals of a Test Access Port (TAP).

Compatibility

The design of the adapter complies with the JTAG / IEEE 1149.1 Standard Test Access Port and Boundary-Scan Architecture. It supports the 5 signals defined in the standard TCK (Test Clock), TDI (Test Data Input), TDO (Test Data Output), TMS (Test Mode Select) and TRST* (Test Reset).

The disassembler displays the TAP controller states as defined in the standard (Test-Logic-Reset, Run-Test/Idle, Select-DR-Scan, etc.).

Adapter

Dual Analysis

The adapter has been designed such that the Dual Analysis Per Pin architecture of the Logic Analyzer can be fully exploited. Simultaneous measurements in the timing and state domain without any reconnection or multiple probing of TAP signal lines are possible.

This single probing methodology also avoids additional DC and AC loading of the TAP signal lines.

Supply Voltage

The adapter contains active circuitry which is powered by the Logic Analyzer.

Adapter Connections

The adapter can be connected to the interface cable between a boundary-scan tester and the Test Access Port (TAP) of a board under test. The adapter contains two 10-pin TAP connectors for this purpose.

played on a single line together with the number of times the state occurred. In this mode both 40-pin connectors have to be used.

Mode II

When the Mode switch is set into position "II" the 16-bit data collection mechanism of the adapter is disabled. Each data bit shifted is now displayed on a separate line in the state display. Furthermore consecutive Run-Test/Idle and Pause states are displayed on multiple lines. In this mode only one 40-pin connector has to be used.

Mode I clearly allows for a longer time interval (more scan patterns) to be traced than Mode II at the expense of 16 additional channels.

Note: The Logic Analyzer cables can be directly connected to the adapter. The adapter connectors contain RC networks for correct signal adaption from the adapter to the Logic Analyzer.

CAUTION

Using the pod cable without the right RC networks can damage the Logic Analyzer.

Switch TDI/TDO

By means of the switch labelled "*SHIFT*" you can select to display either the input of the scan chain "TDI" or the output "TDO" in the disassembler output column.

Installation

To install your Boundary-scan adapter and disassembler, complete the following procedure:

1. Disconnect the target system from any power source.
2. Switch off the Logic Analyzer.
3. Connect the pod cables 1 and 2 to the adapter connectors 1 and 2 in sequence. For mode II, only pod 1 is sufficient.
4. Ensure that the TAP connector pins on the adapter are connected with the corresponding Boundary-scan signals on the target.

CAUTION

Incorrect connection of the adapter can damage the adapter and the Boundary-scan target.

5. Switch on the Analyzer.
6. Power up your target. Proper working of the adapter requires that the reset sequence of the Boundary-scan target must be completed with the adapter connected.
7. Load the appropriate disassembler file (B_SCAN.DIS) from the distribution disk using the option field in the Configuration menu.

CAUTION

Do not connect the adapter onto the Logic Analyzer or target system with power applied to your Logic Analyzer or target system.
Integrated circuits contain protective circuitry against damage due to ESD. However, it is advised that normal precautions be taken to avoid application of any voltages higher than the maximum rated voltages to the adapter.

Channel to Signal Assignment

The first digit of the adapter channel number corresponds with the pod number.
The last two digits of the adapter channel number correspond with the pod channel number.

For example: Adapter channel 1.06 corresponds with pod 1 and channel 6

Adapter Connector 1

Adapter Channel Number	Analyzer Screen Label	Index	Boundary Scan Signal Name
1.00	INSTR	0	3)
1.01	INSTR	1	3)
1.02	INSTR	2	3)
1.03	INSTR	3	3)
1.04	SQIO	0	3)
1.05	SQIO	1	3)
1.06	QUAL[1,3]		3)
1.07	STCK[2,3]		3)
1.08	TRSTN[4]		TRST*
1.09	TCK		TCK
1.10	TMS		TMS
1.11	TDI		TDI
1.12	TDO		TDO
1.13	-		
1.14	TDIS		3)
1.15	TDOS		3)

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Technical Data PF 8683/x6

Electrical Data Adapter

Characteristic		PF8683/36	Unit
Input capacitance[1] (typ.)		40	pF
Input leakage current		± 10	uA
Input voltage	VIL min.	-0.3	V
	VIL max.	0.8	V
	VIH min.	2.0	V
	VIH max.	V_{DD}+0.3	V
Max. TCK clock frequency		12.5	MHz
Min. setup time[2]		40	ns
Min. hold time[2]		10	ns
Max. voltage		6	V
ESD immunity		2	kV

Mechanical Data Adapter

Characteristic	PF8683/x6	Unit
Contact life	100	cycles
Dimensions (l,w,h)[3]	62, 112, 36	mm

Notes:
1. Adapter connected to Logic Analyzer.
2. Setup time and hold time with respect to the positive-going TCK signal edge, which is used as Logic State Analyzer clock.
3. Without pod cables.